APRIL 1971

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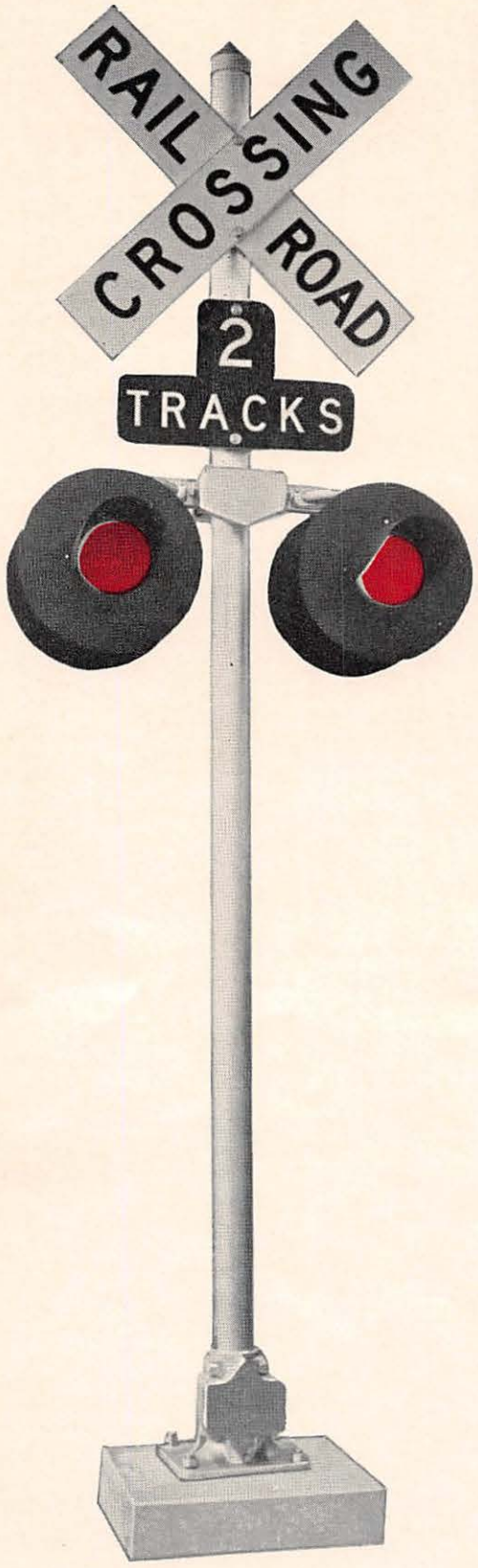

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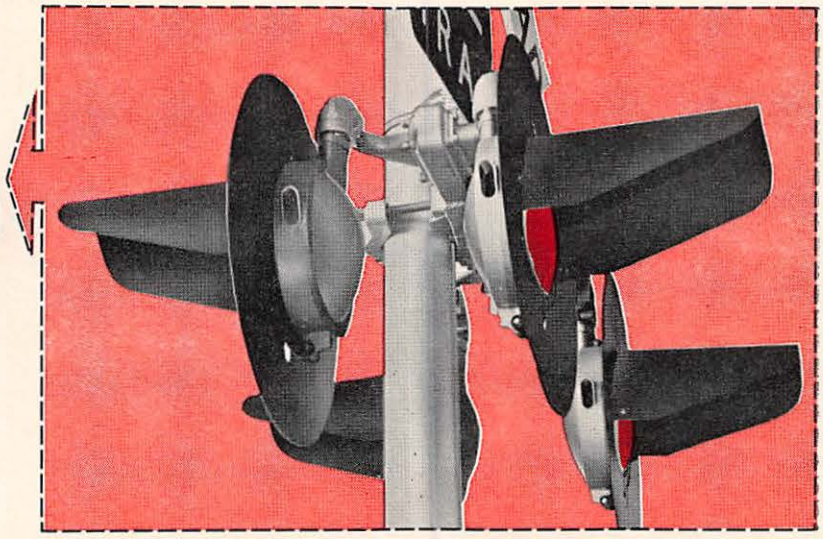

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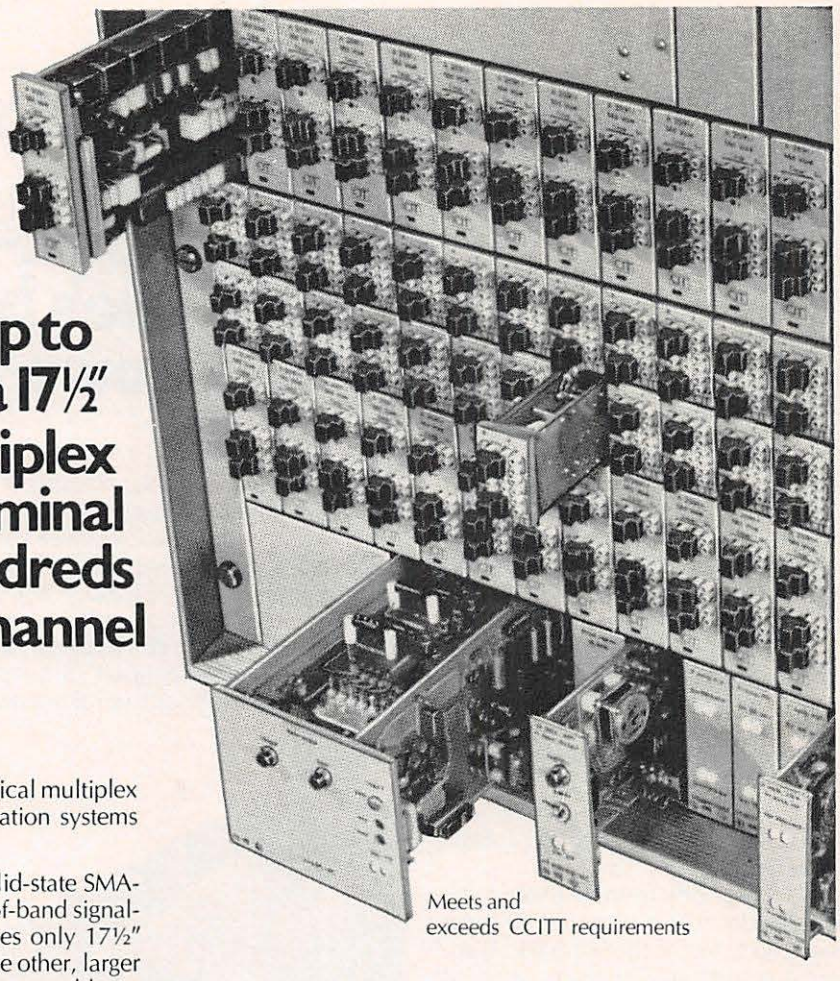

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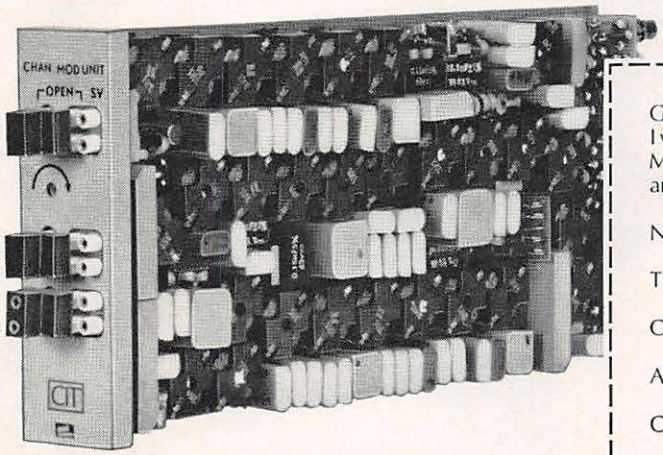

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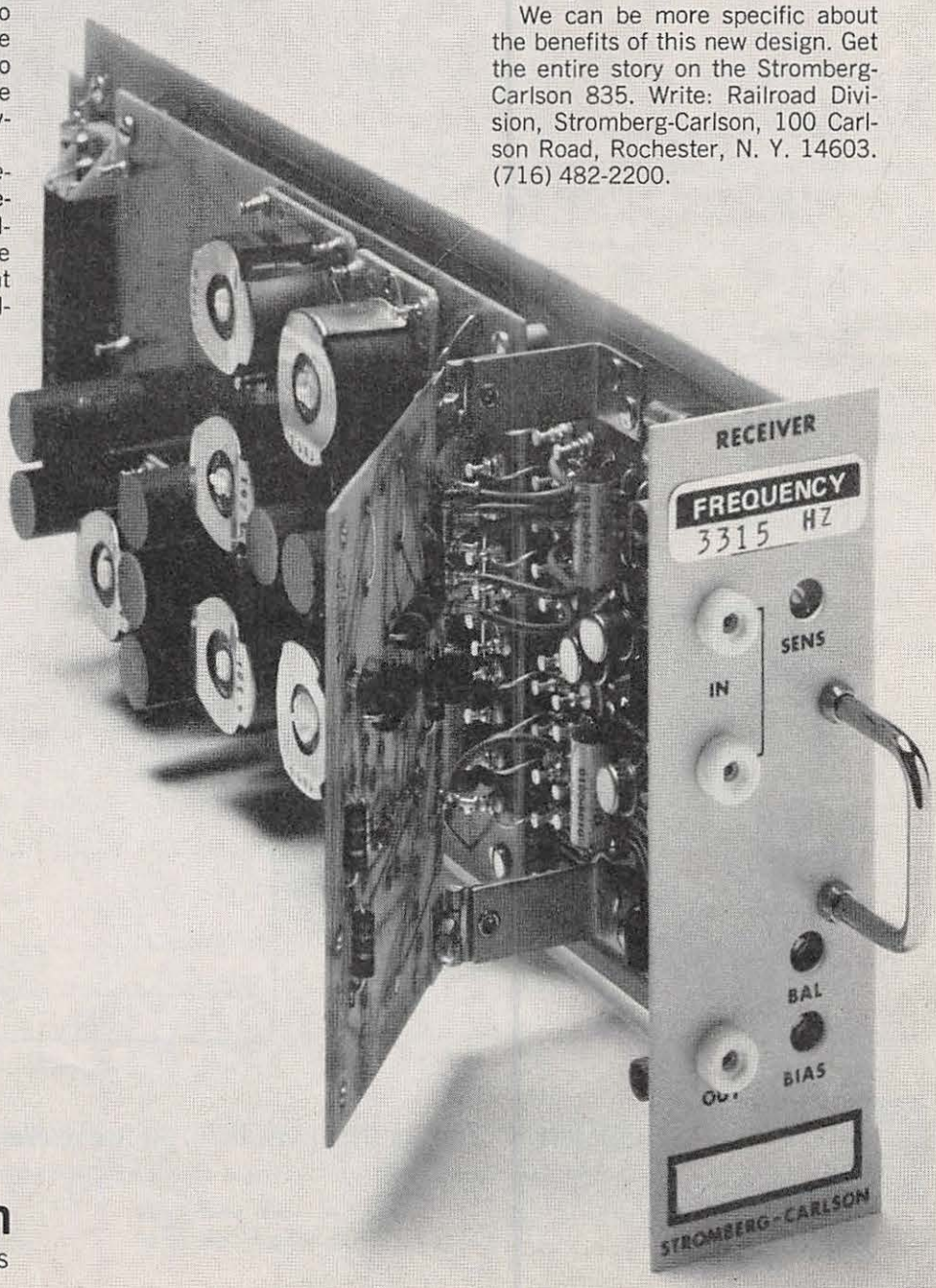

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APRIL 1971 VOL. 2 NO. 4

RSC RAILWAY SYSTEM CONTROLS

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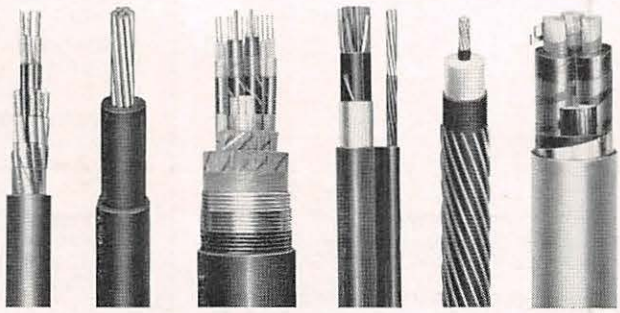

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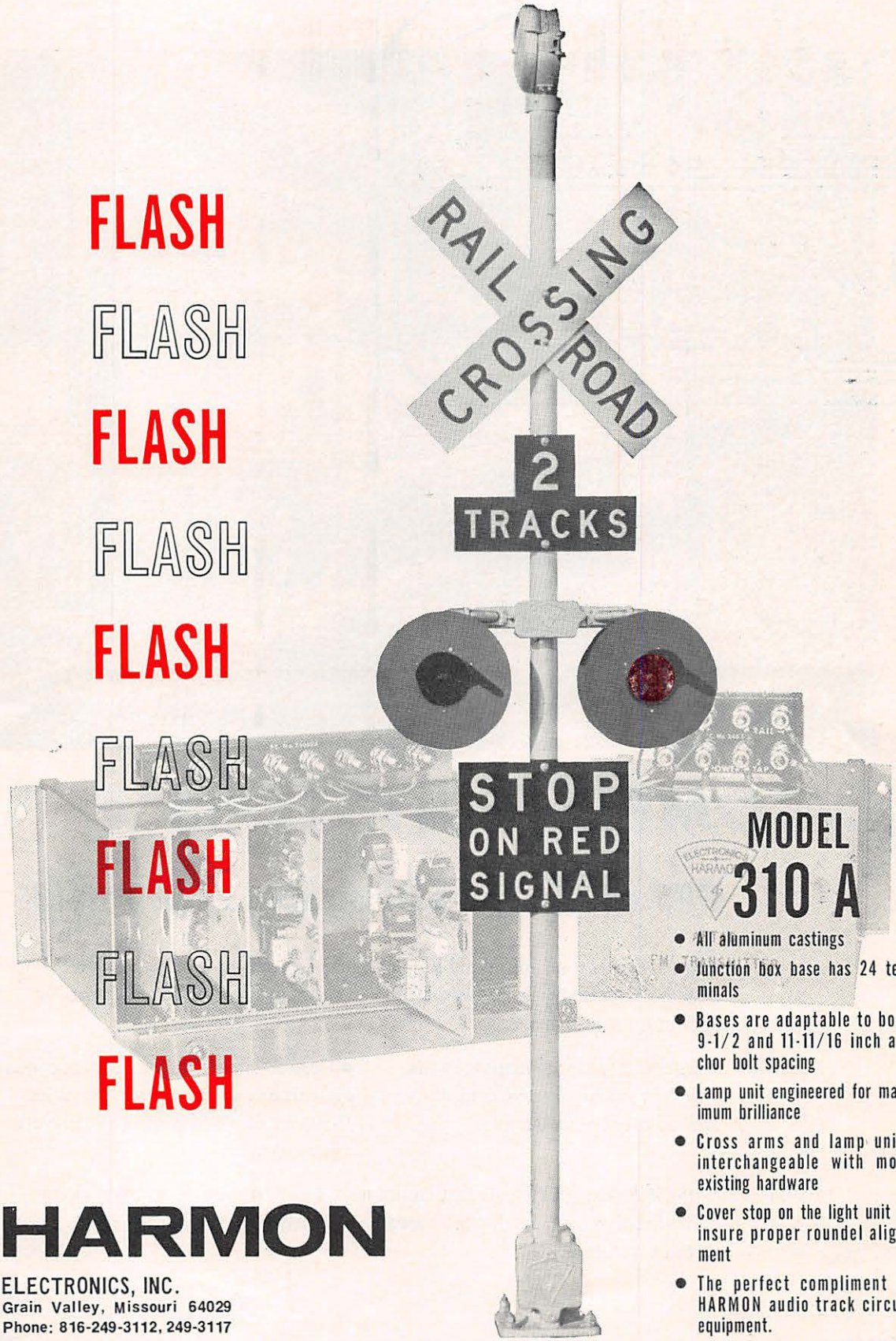

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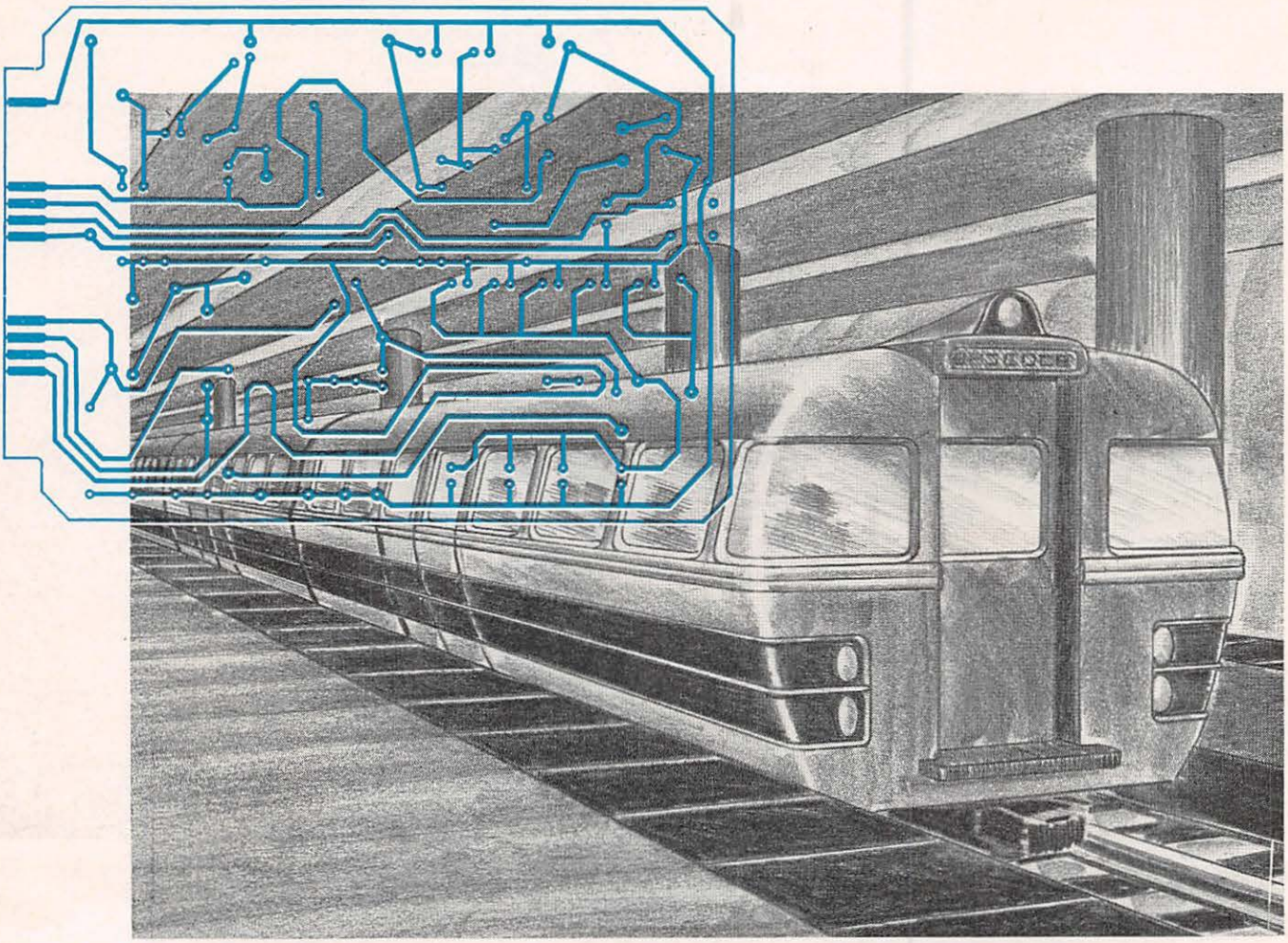

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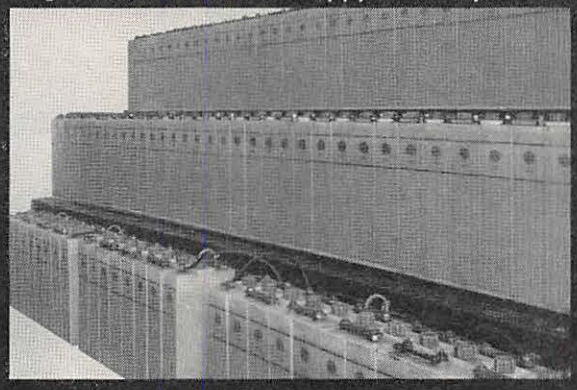

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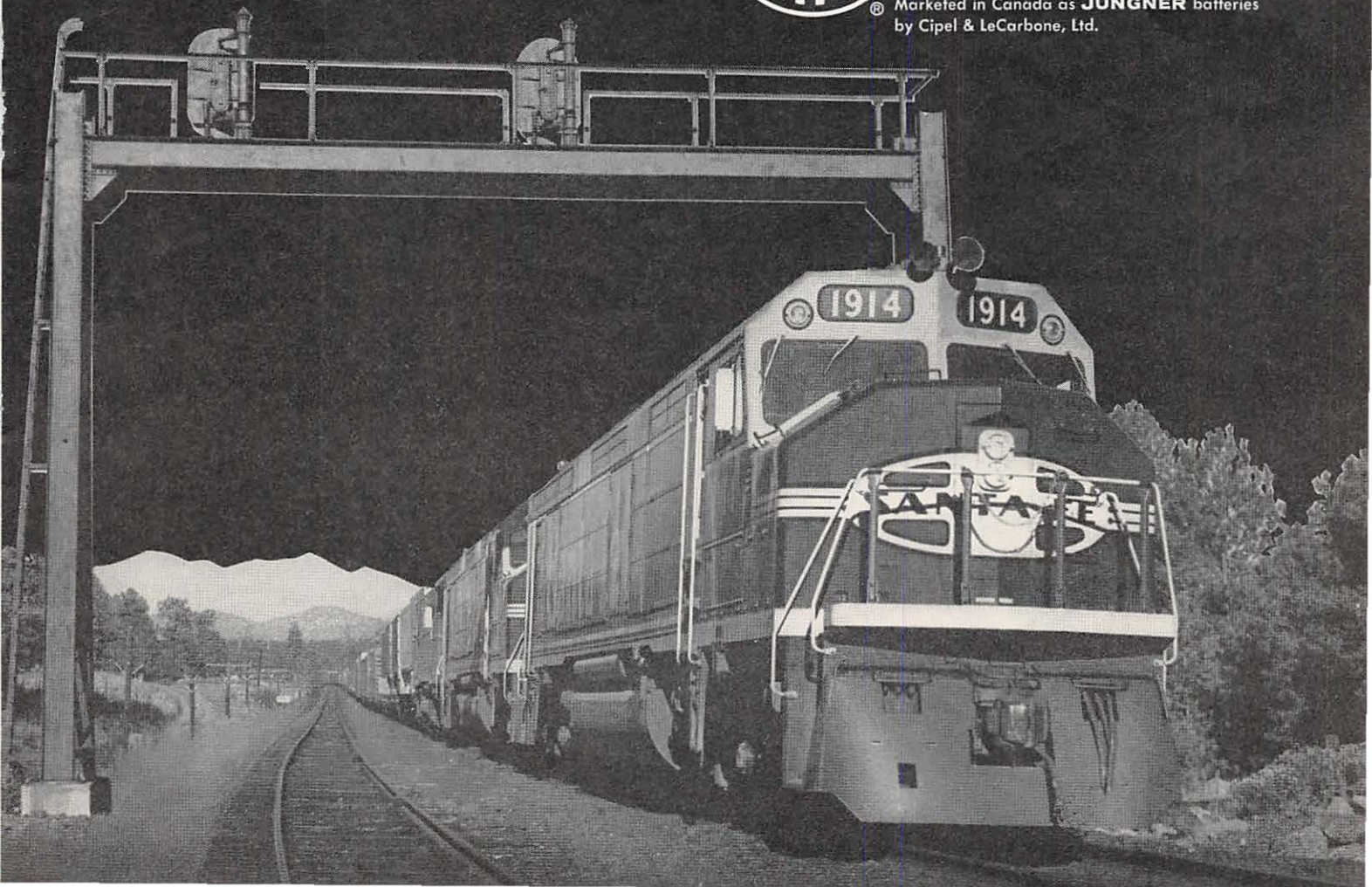

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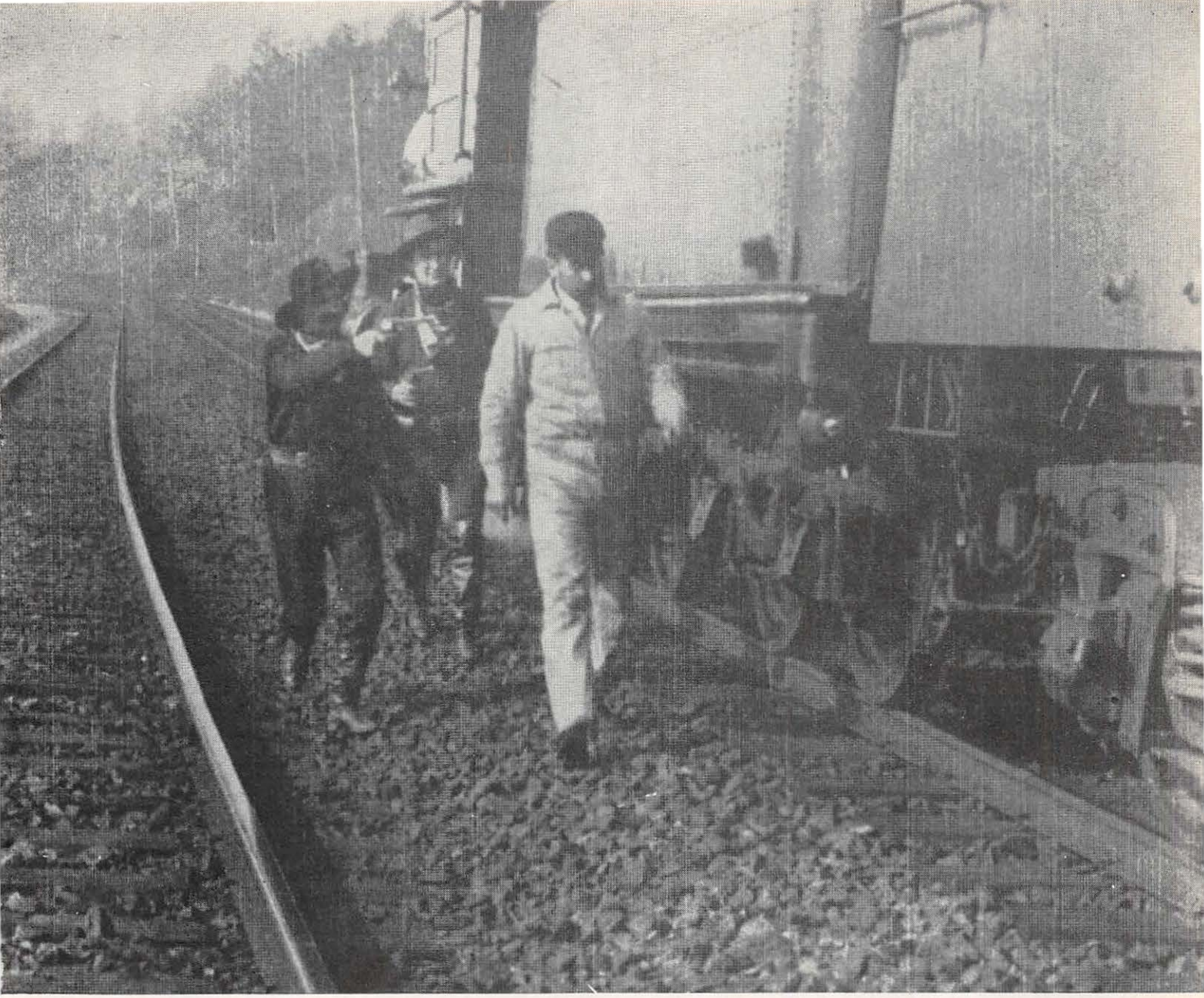

"Never you mind 'bout that new Servo display system you're gettin' next month—right now, start walkin' and don't stop till you find the hot box!"

EVEN without the guns pointed at him, our railroad friend's task of "walking the train" to find a hot journal box was not an enviable one. It certainly would have been simpler and quicker if he did have our new SERVOLARM® Trackside Hot Box Visual Display System.

Designed to operate with a standard SERVOSAFE® Hot Box Detector System, the SERVOLARM visually signals the presence of a hot journal box and also pinpoints its location by means of a digital readout axle count. SERVOLARM helps to eliminate train stops and crew delays. It simplifies and speeds up the entire hot box location procedure by directly notifying the crew via a trackside display board.

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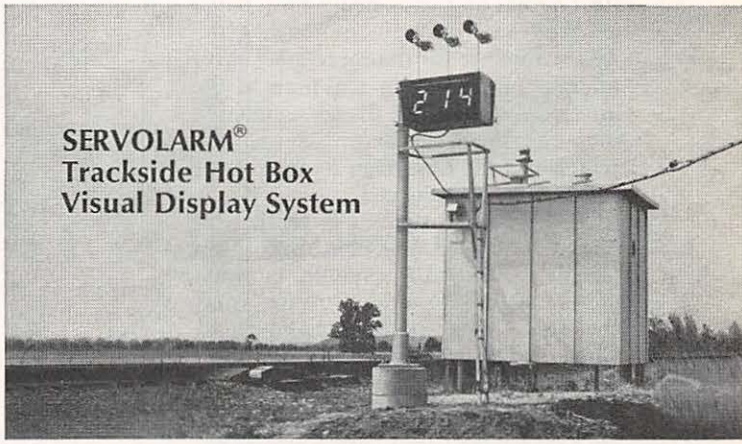

Bi-directional display board presents digital readout, showing axle count location of hot journal box. If no hot boxes are detected, display board reads "000". Flashing signal lamps on top indicate presence of hot box.

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MEMBER RPI

Chicago Transit Authority puts

At one of its busiest rapid transit junctions, tower 12, at the southeast corner of the Loop (Van Buren and Wabash), CTA is providing automatic routing for its Dan Ryan trains. Mixed in with Loop shuttle runs and Evanston expresses, the L-DR trains are correctly routed using automatic car identification. This junction handles 40 trains per hour southbound, where automatic route selection is used over a facing point switch. Northbound moves—34 trains per hour—are over a trailing point switch. Here, route selection is relatively simple—first train to occupy the approach to the interlocking gets the plant.

For southbound moves, the Evanston and "Loopers" (Loop shuttle trains) operate over the facing point switch reversed, and Lake-Dan Ryan trains operate over the switch normal. To reduce car labeling to a minimum, Lake-Dan Ryan trains are equipped with ACI labels. These labels are white retroreflective horizontal stripes (wide stripe is a one, and narrow stripe is a zero). The WABCO laser ACI system is used with vertical scanning. Labels are applied to a panel on the first door of a married-pair car and to the rear door of the other car in the pair. One label, at the front, contains the route number, while the trailing label contains the car number.

In operation, the facing point switch at the junction is normally lined reverse for Loopers and Evanston trains. When a Lake-Dan Ryan train approaches, the ACI scanner reads the route label. This information is sent in real-time to the interlocking controls. If no conflicting routes are lined, the controls normal the switch and the Lake-Dan Ryan receives a clear signal to proceed.

At the present time, only routing information is used, but plans have been completed to send car number information to CTA's computer in the Merchandise Mart where maintenance scheduling data can be compiled. Provision has already been made in the ACI controls for sending car numbers to a Teletype unit at CTA headquarters. A hard copy and a paper tape would be produced, the latter for input to the computer. The ACI routing system has been in satisfactory operation

WHITE STRIPED LABELS identify route and car (this is car number).

MANAGEMENT INFORMATION

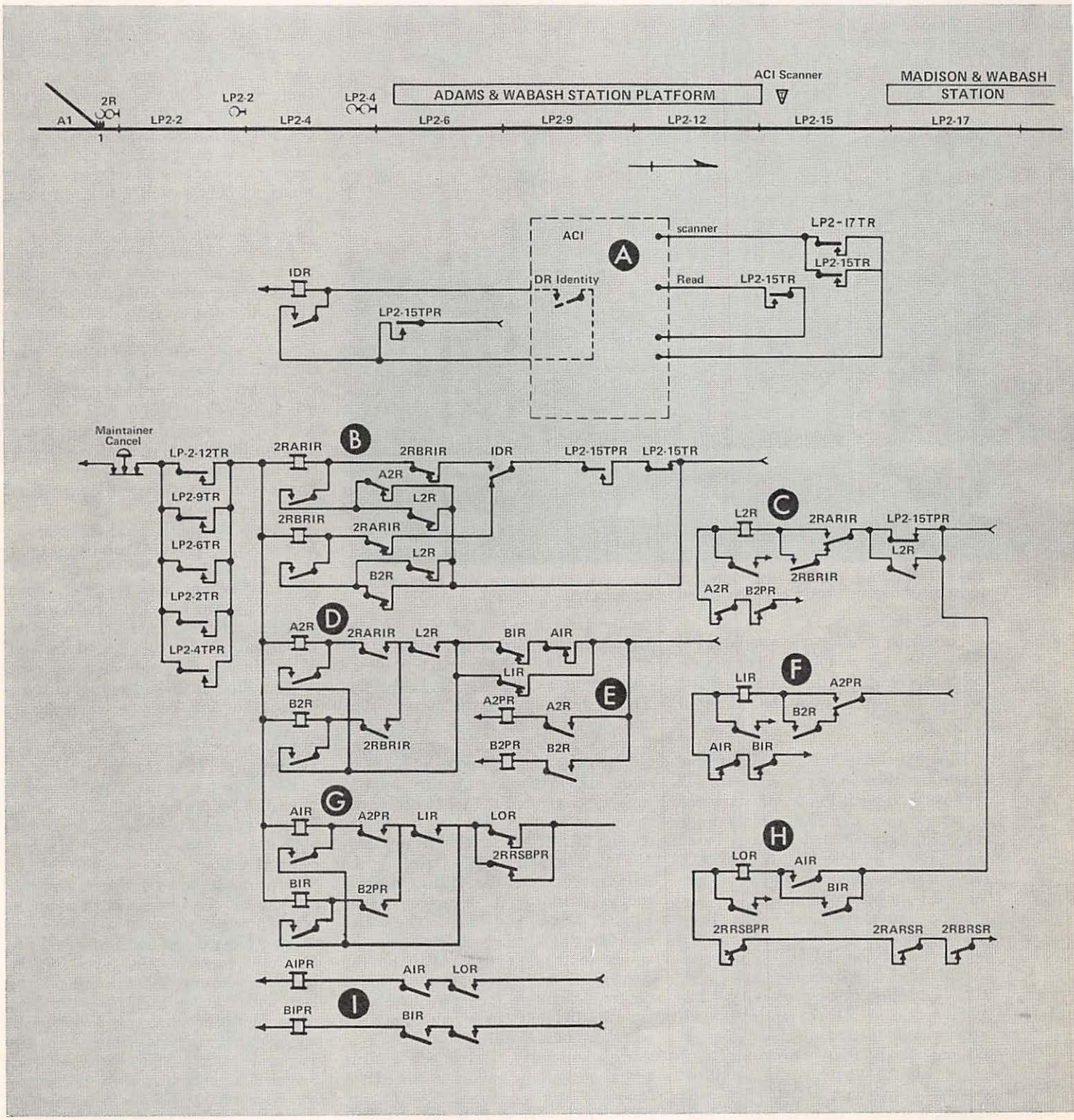
Chicago Transit Authority has found that after six months' operation, its automatic car identification equipment is successfully routing its Lake-Dan Ryan, Evanston and Loop Shuttle trains at a busy junction in the heart of Chicago's well-known Loop. The junction is at the southeast corner—Wabash and Van Buren streets.

All Lake-Dan Ryan trains are equipped with white retro-reflective striped labels that indicate route (on first car of married pair cars) and the car number on the second or last car of each pair.

When the ACI scanner "sees" the label on the front door of the lead car, the Lake-Dan Ryan train is identified, and action is taken automatically by the ACI equipment and route initiation and storage relays to line the junction switch and clear the signal (assuming no conflicting route has been set up) to route the Lake-Dan Ryan train to its proper line.

Lack of an ACI label identifies the train as an Evanston or Loop Shuttle, and the route is lined for the loop instead of straight ahead for the L-DR line.

ACI to work routing trains



CIRCUIT DIAGRAM shows route initiation and storage relays used for routing trains at junction.

LAKE-DAN RYAN TRAINS are routed automatically through the Van Buren-Wabash junction using automatic car identification equipment.

for about six months.

To reduce or eliminate vandalism to labels, they are on folding door panels. When opening, the doors turn inward, so that the label is inside the car out of reach of anyone standing on the platform.

How the route for the southbound Lake-Dan Ryan trains is selected will now be described. Route initiation and storage relays are used to provide route selection. The initial decision is based upon action or inaction of the ACI equipment—whether a labeled or unlabeled train passes the scanner.

As a southbound Lake-Dan Ryan train approaches the ACI scanner at the north end of the Adams-Wabash station platform it will occupy track circuit LP2-17. De-energizing of relay LP2-17TR will close a back contact providing a circuit to turn on the ACI scanner (A). As the train moves into track circuit LP2-15, its relay is de-energized closing back contact LP2-15TR placing the ACI scanner in the "read" mode. When the scanner "sees" the ACI label on the front door of the lead car, the Lake-Dan Ryan train is identified and a DR Identity relay contact is closed completing a circuit to the IDR relay. This is held up through its own stick and the track repeater LP2-15TPR down. What is desired is energizing relay 2RARIR (the "A" route or Dan Ryan route initiation relay). At this point in time (see area B), LP2-12TR is up (train not yet on that track circuit), contact 2RBRIR is down, IDR up, LP2-15TPR down, LP2-15TR down. As the train moves into the Adams-Wabash station platform it occupies circuits LP2-12, LP2-9, and LP2-6. The corresponding track relays drop, hence the circuit to the left of 2RARIR on the drawing is completed. As the rear of the train clears track circuit LP2-15, relay LP2-15TR is energized. The track repeater LP2-15TPR, however, is a slow-pickup relay, so that for a short period of time the circuit to 2RARIR is complete over contacts LP2-15TR up, LP2-15TPR down, IDR up, 2RBRIR down and LP2-12TR or LP2-9TR or LP2-6TR down. Thus, the A route initiation relay is energized.

A front contact of 2RARIR closes in the circuit of lock relay L2R (C), but this relay is not energized until the slow-pickup track repeater is energized which closes a previously open contact LP2-15TPR. With L2R energized, its contact in the A2R circuit picks up (D) and with 2RARIR already up, the circuit to relay A2R is completed.

The A2R front contact (E) picks up completing a circuit to relay A2PR, which in turn completes a circuit to relay LIR (F). Also with A2PR and LIR energized, contacts of these relays complete a circuit to relay AIR. An AIR front contact closes to complete a circuit to relay LOR (H). With front contacts AIR and LOR closed, relay AIPR (I) is energized, which provides contact closure to vital relays providing for controlling switch 1 to the normal position and clearing signal 2R for the Lake-Dan Ryan route.

For an Evanston or Loop Shuttle train, a similar sequence takes place but the ACI equipment does not provide a circuit to energize relay IDR. Thus in area B, back contact IDR remains closed and route initiation relay 2RBRIR is energized when the southbound train vacates track circuit LP2-15. Subsequently relays B2R, BIR and BIPR are energized to provide contact closures to the vital relays for establishing the route around the loop. This aligns switch 1 reverse and clears signal 2R for the loop route.

Aspects for southbound trains are as follows: For a Lake-Dan Ryan train, the motorman receives a yellow-over-lunar white on signal LP2-4, lunar white on signal LP2-2 and lunar white-over-red on home signal 2R with the switch normal for the Dan Ryan line. If the home signal holds at red-over-red at the time a Lake-Dan Ryan train passes the ACI because a conflicting route had cleared, signal LP2-2 (approach to home signal 2R) will display yellow for the Lake-Dan Ryan train.

For Evanston or Loop Shuttle trains, signal LP2-4 displays yellow-over-lunar white, approach signal LP2-2 displays yellow and home signal 2R displays red-over-yellow.

If no route or an incorrect route is established, the motorman of a southbound train stops at a two-lever route selector located just north of signal 2R. He fully depresses the lever for the route he desires—"L" for around the loop and "D" for the Dan Ryan line. After depressing the route lever it will take approximately one minute for the new route to be established. It may take longer if a conflicting route is clear or has been initiated prior to his arrival, in which case the conflicting route will clear first.

Area and headquarters control systems chosen by C&O / B&O

BY DR. H. N. LADEN
Assistant Vice-President,
Research
Chesapeake & Ohio/
Baltimore & Ohio

Any projection into the future needs to start with where we have been, where we are now, and the factors making for change in the years ahead. So, let's look at the railroad computer applications in place and the functions they are serving already. Let's look also at the techniques which we in the railroad industry are already exploiting in our data systems. Further, let's reflect on the shortcomings in what we have accomplished, the continuing problems before us and the business pressures on us, the visible technological advances opening new opportunities for us, and the other factors impelling us into further significant progress.

With this base for forecasting the systems of the '70's and with an examination of the principles to consider in deciding where to go, we have formed our views on how C&O/B&O should shape its future. Here's how we look at it on C&O/B&O.

To set the stage, let me give you a thumbnail sketch of the C&O/B&O System. We have some 11,000 miles of main line track, which stretches through 14 states and Canada from the Atlantic Seaboard in the east to Chicago and St. Louis in the west, tying together all of the major industrial centers in the east. There are some 44,000 employees. We own 135,000 freight cars and 2,200 locomotives. C&O/B&O assets, at book value, are in excess of $2 billion. In 1969, our gross revenues were $875 million; our earnings were slightly in excess of $52 million.

C&O was the first railroad, and among the first industries, to install a large-scale computer. That was UNIVAC I back in 1954. At the present time, we have ten large-scale computers and several minicomputers in place and working for C&O/B&O, as well as time-sharing facilities linked to UNIVAC 1108-'s, CDC 6600's, IBM 360-65's and GE 635's. We're running a very substantial bundle of applications on these systems—processing roughly ten million transactions a month.

Like many railroads today, we have a computer-controlled communications network. Ours includes all C&O/B&O consist and administrative traffic. It covers 65,000 line miles and some 700 communications terminals. One of the major uses of the communications system is for our car and train movement reporting system or Transportation Data Systems as we call it. Incidentally, we are currently handling by video display devices and by Teletype about 10,000 requests a day to trace cars. Of course, in addition to tracing, our Transportation Department relies heavily on TDS for information for running the railroad and monitoring the quality of service performed. TDS and our waybill-based Traffic Data Systems produce and send out a vast amount of sales and marketing information.

As you might expect, there is a whole family of computer systems aimed primarily at accounting and financial control—such as revenues, materials, payrolls, car accounting, stockholder records, and a financial reporting system.

Despite accomplishments to date, use of computers on C&O/B&O and other railroads—as in much of U.S. industry—is just out of its childhood. Initially, the emphasis of computer applications was on the accounting areas, although there was some support provided also for transportation and traffic. The latter support was mainly car and train movement reporting which grew from telegraphic advanced consisting and resulted in central car files and automated car tracing and movement reporting. Almost all of these initial computer applications were strongly oriented to the needs of headquarters rather than of field personnel. Many of these data systems were for processing which is companywide in nature—car accounting, revenue accounting, materials management, etc. This approach to the use of computers has been followed by the entire railroad industry as well as most other industries.

There were good reasons for this course. Many of the functions studied had already been centralized and were being processed on punched card equipment. This made it relatively easy to convert the operation to computer processing with substantial benefits in a relatively short time. Most of the applications involved fairly large concentrations of clerical personnel and were areas where much detailed knowledge existed about the systems and procedures required. Many of these earlier computer applications were high in priority because they resulted in very substantial reductions in clerical personnel and enabled us to afford the expensive, large scale computers of the first generation.

For example, on C&O/B&O our Station Service Bureau project facilitated station closings and dualizings, contraction of forces at large agencies, and drastic reductions in headquarters personnel engaged in Freight Accounting and byproduct traffic statistics. Coincidentally, the Station Service Bureau project provided an economical solution to the waybill and freight bill preparation problems which enabled us more completely to automate interline accounting, to gather detailed customer and routing data in coded and machine language, and to construct a comprehensive Traffic Data System.

Much of our activity in more recent years has been directed at modifying and expanding the areas of original application. In part, this was due to the desire to achieve the benefits and savings from the use of more advanced computer hardware. But a major motivation has been the growing demand by all departmental users, after getting a taste of the computer, for more extensive and more timely management information.

Thus, as a result of prior work, there presently exists on C&O/B&O and on most roads a very substantial bundle of computer systems capable of supporting most of the headquarters management functions. But even with the advances made, there are still residual inadequacies, unsolved problems in our current systems and serious gaps in the functions being served by them. The major problem with existing computer systems, and the one which hampers their more complete acceptance and more intensive utilization by management, is the shortcoming of quality of input—incorrect data put into the system and missing, late or incomplete data.

In large part, the current input problem reflects the larger problem of obtaining adequate clerical help, training and supervising it properly. Only efforts aimed at minimizing the reliance on clerical forces seem to offer a solution. We must seek out and apply Source Data Automation techniques and associated computer processing to

reduce the dependence on quality of clerical effort. These same techniques should also increase clerical productivity, as well as reduce the cost of input preparation and of subsequent clean-up of defective data. Moreover, high quality input will increase the management reliance in and use of computer information.

Not only complete and error-free inputs, but also timely data collection and processing have come to be of importance with the rise of on-line, real-time management systems. Instant availability of current data on demand is often the key to the ability of management, particularly out in the yards and terminals, to use the computer to help with solving day-to-day problems.

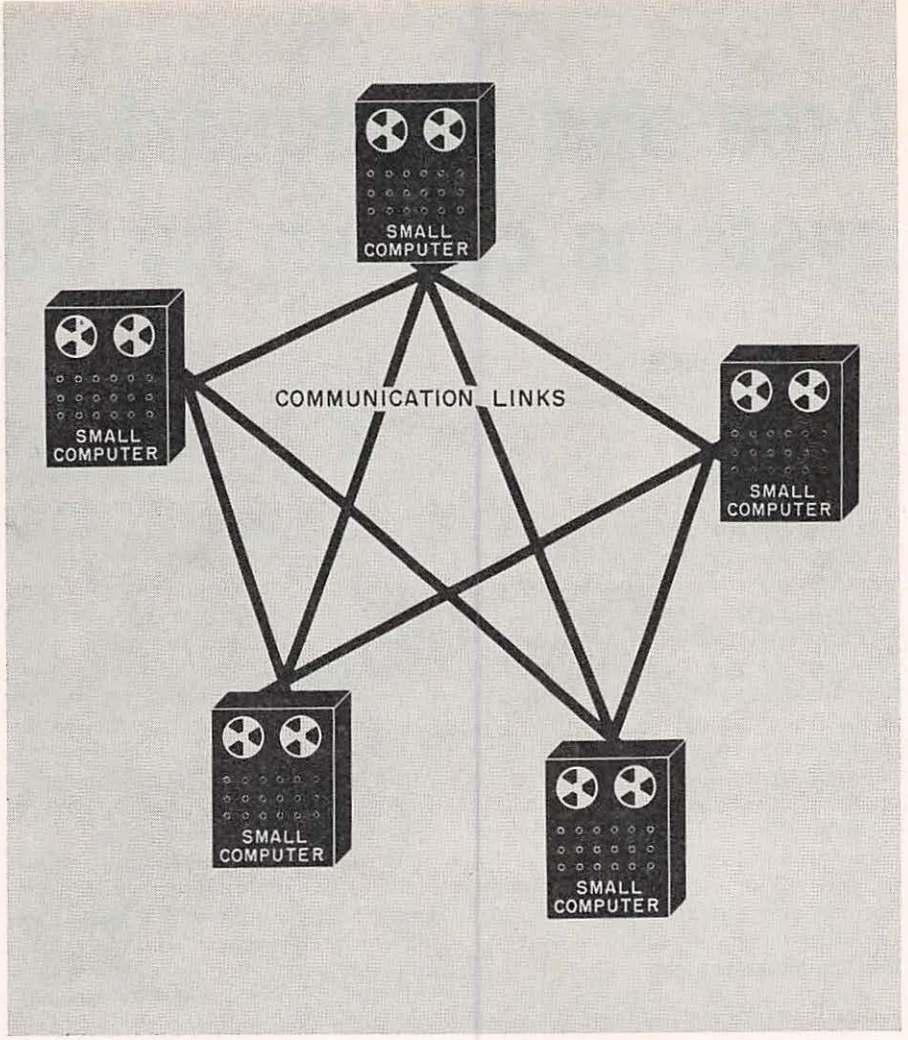
There is also a demand for more intelligence to be built into our data systems, for more applications of the tools of management science as aids to decision making at all levels of management. There is a growing recognition that analytical techniques and computers are essential to the coordination of the parts of a complex transportation system.

Another major influence for change today is in the new advances in hardware. Today—in contrast to a few years ago—there is a great variety of I/O (input/output) devices and data terminals ranging from the very simple to the very intelligent. Computer power is less costly. There are time sharing, mini-computers, multiprocessing, ACI, more intelligent source data automation devices, more sophisticated teleprocessing, distributed computer/communications capability, and others.

Full utilization of our existing systems and our planned ones means an explosion of digital data transmission. This comes at a time when AT&T is persistently increasing our cost of communications. The drop in cost of computers and the rise in cost of communications compel us to seek configurations of our computer/communications network which are more economical of communications.

Finally, we cannot ignore the business pressures calling for the twin goals of better service and reduced costs. Shrinking car fleets and higher car hire costs intensify the pressure for improved car utilization. Fewer but stronger competitors confront the sales forces at a time when the customers are increasingly sensitive to service deficiencies.

It becomes apparent that our highest priority must be on providing improved information support for Transportation and Traffic management. They are at the heart of the business, where most of the money is made and spent and where most of the people are. Within Transportation/Traffic, there is general agreement that control of operations in yards and terminals is today's major cost and service problem. Yet, with a few exceptions, existing computer data systems are not geared to help management in yards and terminals at all or, at most, in only a meager way.



DECENTRALIZED SYSTEM requires the use of many small computers scattered over the entire railroad system.

In every discussion with field management some of them invariably exclaim, "Your data systems are very impressive and fine for the people at headquarters, but when are you going to give me direct help with my many minute-to-minute, working problems in the field?" Many of these Operating men feel strongly that their job performance is being inhibited by lack of necessary data, too much reliance on deteriorating work forces, lack of computer help, and continual struggling with yesterday's methods in trying to operate in today's increasingly pressurized and automated world.

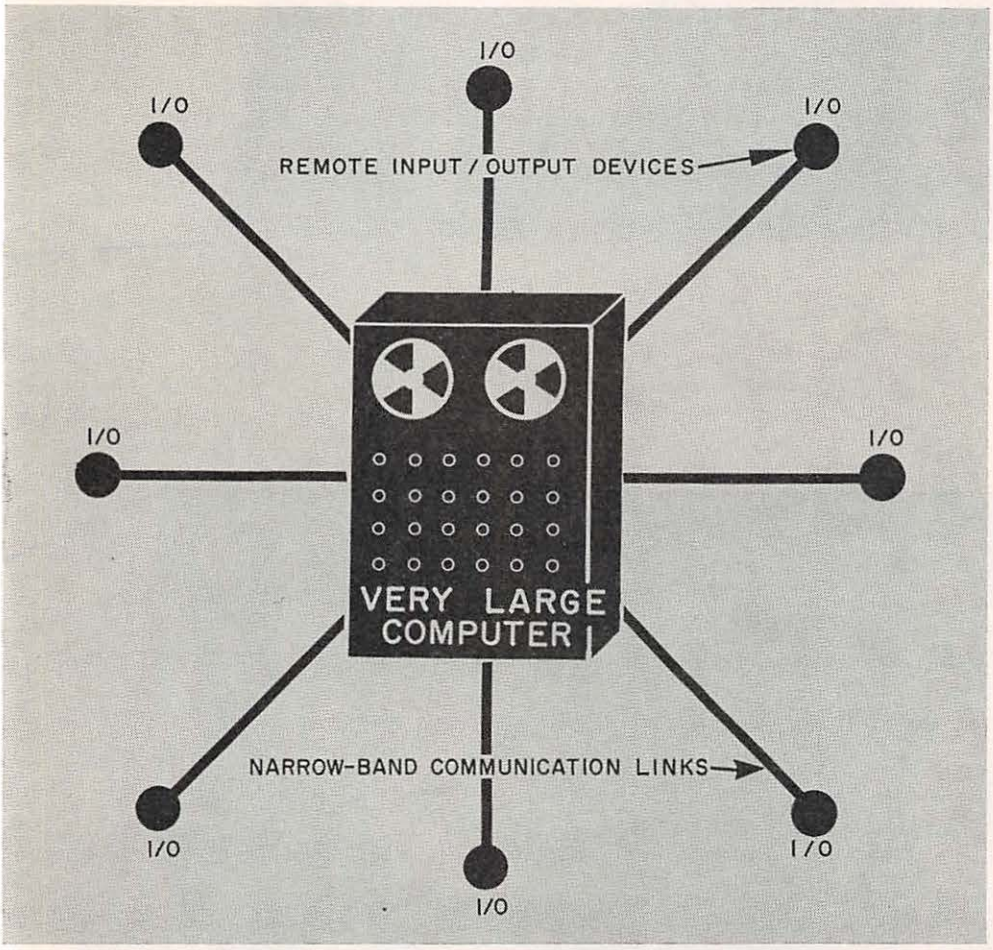
These complaints are not peculiar to C&O/B&O. They are common to all railroads. In response to them, there is a large movement currently in the industry towards the more advanced "car movement systems." All of these approaches have at their foundation the aim of providing better Transportation and Traffic information in a more timely manner. Obviously, Operating Management in virtually every major railroad is convinced that such information can be exploited to improve service to shippers, reduce car delay and reduce cost.

The many factors compelling change present us with a clear set of challenges, and we are going to respond to them—improve quality of computer input even while cutting cost of preparation; on-line, real-time data entry; direct access to data banks in an inquiry/response mode; low cost I/O devices and computing power to help the guys in the field; and more detailed data about what is going on inside the yards and terminals to provide control of field operations.

What is going to be our response?

We are going to expand our data systems functionally and by level of organization and geographically. The span of applications will widen to integrate more completely activities now spread among departments. At the same time, the use of the computer will penetrate to all levels of the organization. At Headquarters, there will be more effective coordination of geographically spread but interdependent activities.

Clearly, this requires the implementation of a large scale computer/communications network. The big question



CENTRALIZED SYSTEM provides the lowest computer and personnel costs but with the highest communications costs.

is—How to organize it in the most effective and economic fashion?

The answer depends upon what we want such systems to do. They must be companywide, interdepartmental in design, and serve all levels of management and all locations. They must organize computers, communications, input/output devices and people for service, transportation operations, selling, production, bookkeeping, etc. They must cope with a deteriorating work force by reducing the dependence on clerks in numbers and quality through consolidating and automating. They must balance network economics and response characteristics by considering the trend toward greater data volume, reduced computer unit processing cost and higher communication unit traffic costs.

What are the other technical requirements for such an information system for a major railroad such as C&O/B&O? The more critical ones are: large volume of data to be processed, long distances to be covered, need for real-time information and fast response time, reliability, ability to expand the system easily, and efficiency of operation.

There are probably as many different approaches to the architecture of such a computer/communications network as there are data systems planners. Each individual approach offers its own set of advantages and disadvantages. The choice of a given configuration inevitably involves some tradeoffs. To study and evaluate the alternative network configurations, we constructed a computer simulation model for the networks. This enabled us to consider the costs and technical effectiveness of numerous configurations. Using the model, we have analyzed in depth the alternative ways of fulfilling C&O/B&O's needs for such a data system, providing information for improving service and "production line" activities in the field, and coping with the company's widespread clerical problems. C&O/B&O's short-range and long-range requirements have been considered. We evaluated a totally centralized network, a thoroughly centralized network, a thoroughly decentralized one and some intermediate varieties.

In a completely decentralized system, no interconnections would exist among the many computing centers in the system. Some communications could take place through such means as the exchange of data tapes, but this would be handled relatively informally. The inherent independence of each computing center in a decentralized system means that each would have sufficient capacity to meet the local demands.

In other words, decentralization means the use of many small computers scattered over the railroad. Give every man his own computer. While perhaps not literally true, we could proliferate computers over the entire property. Decentralization can be both geographic and departmental. For a road as large as ours, this could mean eventually computers numbering in the hundreds.

Linking a large number of such installations together ranges from the difficult and complex to the impossible, and the costs of intercomputer communications bought in small lots are high. There is a sacrifice also of speed, capacity and economy of scale of the larger computers.

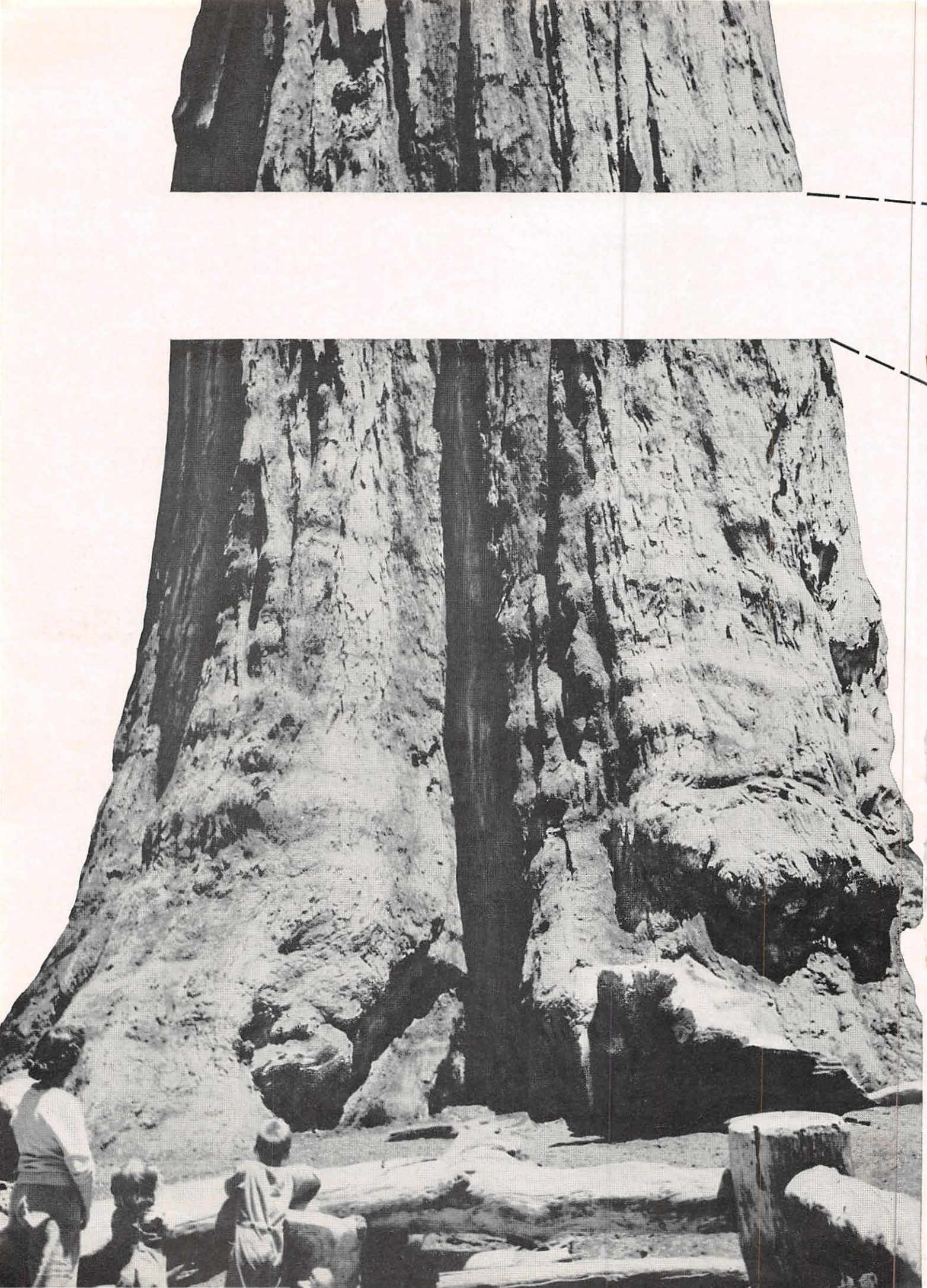
In a highly decentralized computer/communications network, lack of sophistication arises in system design and choice of applications because each computer location is too small to support a large computer system with a full complement of powerful hardware, software, and personnel. When each computer is geared only to local needs and coordination of the railroad is ignored, optimization of the company's total data processing cannot be obtained. But perhaps of greater importance is the fact that the "little computer" approach impedes functional integration, causes multiple data entry for different purposes, creates extra costs of file overlap and gaps in any one file, injects inconsistencies in data in different departments, provides more narrow and limited information, and confuses customers about where to turn for service. These problems translate not only into limited systems, but also excessive cost for clerks, computers and communications.

There are two very significant advantages of the decentralized approach. Each computer center can tailor its system precisely to its needs, obtaining hardware and software appropriate for its peculiar problems.

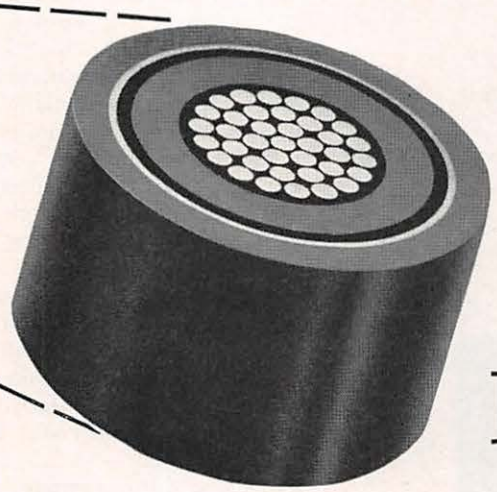
And system reliability is relatively high. The total system is unlikely to fail all at once. Total failure may occur at any given location, of course.

In contrast, in a highly centralized system all local input/output installations are linked by communications channels to a single "central" point. All the computing capacity of the entire system is located at this site. The computer at the central location must be designed to service the computing demands of the entire system. The remote terminals have no stand-alone computer capability except for a basic communications-oriented processing.

We have maximum centralization of



Each ring of growth is mute evidence of this monarch's success in meeting the test of time.



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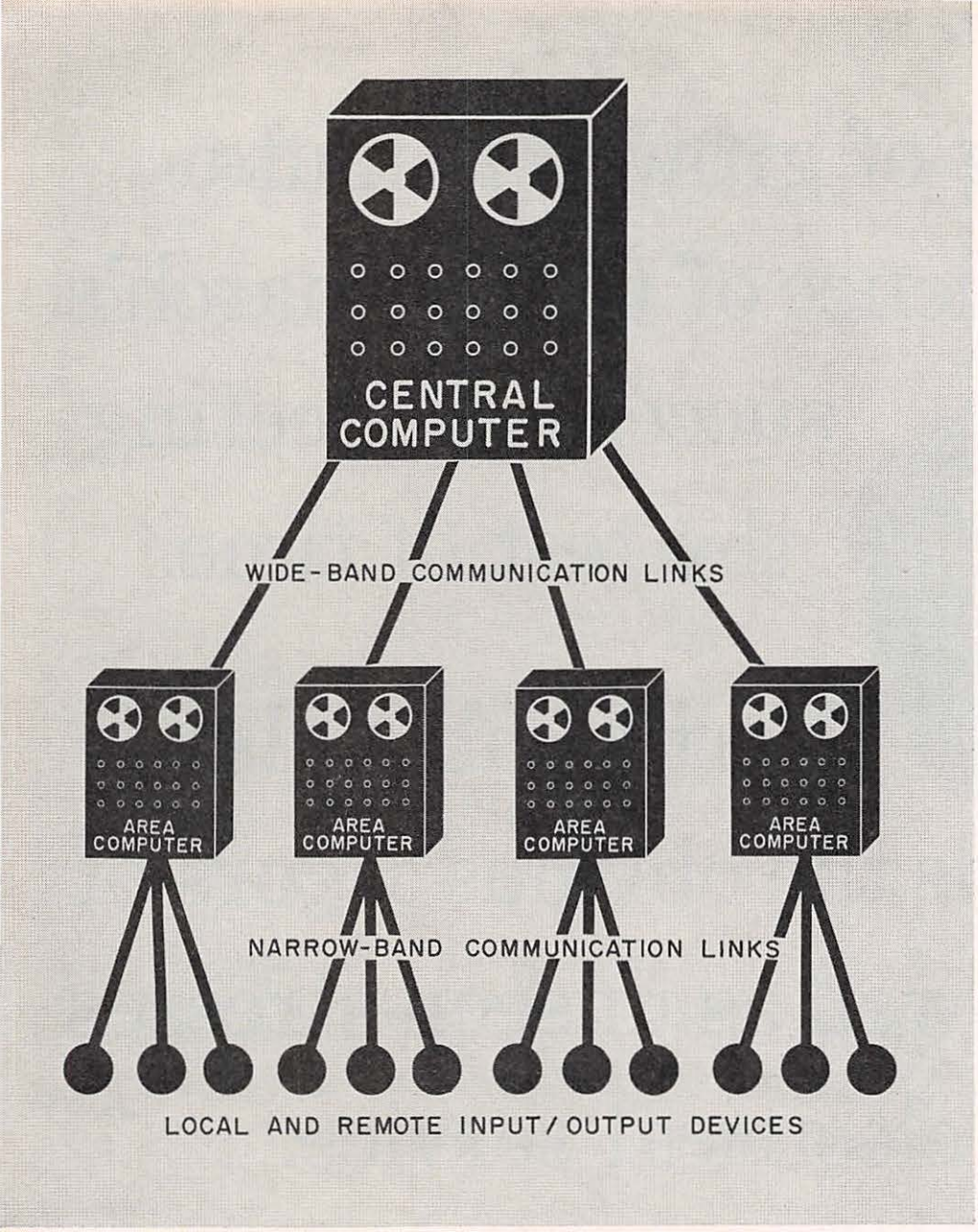


IN A DISTRIBUTED NETWORK of computers, all centers would be interconnected by communications channels.

computers requiring the greatest length of narrow-band communications lines. This will give the highest communications cost because it requires the longest hauls at the highest unit costs. But it does give the lowest computer and personnel costs because of the ability of the largest computer to do the most processing at the lowest unit cost. It requires companywide files without geographical or functional specialization. This facilitates centralized planning and control but, as a result, there will be maximum contention for the files from among the many users in the railroad—with consequent delays in response time. A totally centralized system may "bottleneck" and not be able to get its job done. A companywide file may be so large as to exceed the limits of practical storage devices.

While the basic concept is simple, a centralized system is always more complex than any of the individual systems in the decentralized system. This is essentially because it is a many-fold larger system. Multiprogramming and communications require complex software. There is a large cost in terms of the size and complexity of generalized programs which serve the whole organization. The operating systems required to manage a complex centralized system exact substantial costs in terms of systems overhead.

Long communications lines and transmission back and forth to headquarters of all the detailed information needed to run a terminal means delay in updating headquarters and in response time to the terminal, as well as added cost. Similarly, delivering all bills of lading to a single point for waybilling only at headquarters would tie up cars and be utterly impractical. Processing of all the detailed data at headquarters means additional computer time and cost as well as delay in getting results to the man in the field.

In fact, total centralization, that is, providing at one point the level of processing service which all of the company users require, approaches or exceeds the practical limits of technical performance.

Further, there often is a reaction from the local managers who have a lack of confidence in the central machine, and who may want a computer of "their own." The realities of the situation are that people can make or break computer applications by cooperation or disinterest. Priority scheduling is always a political issue and is more severe in a centralized system. Each user wants top priority for his jobs. Obviously, this is not possible. This contention for priority also loses friends and hampers the successful operation of a centralized network.

But above all, centralization is an incautious approach. A major catastrophe, such as a power failure, at the headquarters location could knock out the entire railroad.

The costs of the computer-communications networks involved in highly centralized computer systems for management of large railroads have been studied closely. Tentative sketches of similar networks to serve the C&O/B&O have been made, and we have priced them in our computer simulation model. In terms of all computer-communications hardware and required communications channel capacity, a heavily centralized set-up for C&O/B&O has proved to be far more costly than one distributing computer-communications hardware more widely. Extreme centralization or decentralization generates extreme costs.

Between the two extremes of decentralization and centralization are many possible alternatives; for example, two or three large computers instead of one very large one, the use of a large variety of more intelligent input/output devices for use with varying numbers and sizes of computers, and so on. Consider such a system between the extremes.

In a distributed network of computers, all the centers would be interconnected by communications channels. The centers would have facilities at any one of several levels of complexity. For example, they may have terminals with no computing power beyond data compression or code translation, data base storage where a reservoir of information is stored remotely for some reason such as ease of data collection or economy in data transmission, specialized machines such as process control computers, or a general purpose computer with any level of power and variety of programs.

A modest central computer may be

linked to one level of distributed computers and, where necessary, hierarchies of distributed computers. This arrangement permits the use of various I/O devices ranging from the very simple to the very intelligent. This approach also reduces the length of narrow-band channels and provides for filtering out of data irrelevant to higher levels of management. This, of course, lowers communications cost. Data files can be maintained at each level to reduce the volume of information relayed from one level to another. At the same time, the local computers can serve as data concentrators. Relay of information between computers could then be over wide-band channels with lower unit cost communications.

The central computer in a distributed network will be smaller than under a totally centralized approach. It will perform system coordination jobs. It will have a smaller communications problem. Contention between multiple parties having more or less simultaneous need for access to each commonly used file will be reduced. Distributed files can be multiple where necessary and geographically specialized where possible—response time will be quicker, data degradation reduced.

Distributed networks of computers can be seen to offer several of the advantages of both centralized and decentralized systems.

Only some of the economies of scale in computing available with a centralized system are lost in a distributed network and exchanged for economies of communications not available in a centralized system.

The cost of communications will be reduced and reliability increased with this approach. Local computers in the network can perform preliminary calculations and summarize data, transmitting only essential information to more powerful computers. This would reduce the distances over which relatively low speed, high unit cost communications would be used.

Messages would be communicated for the greater part of their journey at the "wholesale" rates available for high speed communications over the higher capacity channels. This is an economic necessity in the communications associated with widespread installations of ACI scanners and a multiplicity of terminal varieties. Also, replacing the very large number of low-speed lines coming into the headquarters message switcher in a centralized system with the small number of high speed lines coming into the switcher in a distributed system permits great simplification of the headquarters communications function. The interconnection of centers makes any special purpose computer available to any center in the network.

Since centers have computing power of their own, failure of the more powerful center or of the communications lines need mean only some degradation of service and not total failure.

There can be greater local control in a distributed network than in a centralized system. There is also a real machine present at the distributed centers for the local manager to treat as his own. There can be a substantial degree of geographical specialization of data systems and a degree of local involvement in their developments.

The ability of distributed networks to adapt to changes in computing technology is one of their most important features. The system can be shifted (in terms of the locale of computing power) along the spectrum from centralized to decentralized.

This picture is not perfectly rosy, however. Distributed networks do suffer from some disadvantages.

The computer hardware and personnel cost for a distributed network may be more than for a centralized system because it requires more computer operating groups and it cannot take full advantage of the largest possible computers.

Distributed net is complex

Further, a distributed network is obviously much more complex than a decentralized system. The situation is not so obvious in comparison to a centralized system. The fact that local computers in a distributed network can carry much of the load and that they can do a great deal of data summarization means that the application programs at the more powerful system center can be simplified. The system software in a distributed network, however, may be considerably more complex than in a decentralized network.

Our examination of the advantages and disadvantages of the various designs showed clearly that distributed networks combine the principal benefits of decentralization and centralization. The distributed network's disadvantages of computer cost and system complexity are acceptable, offset as they are by communications savings and faster response time. The four most significant features of the distributed network are economies of scale in communications, fast response time, low vulnerability and flexibility. The ability of a network to shift along the spectrum between the centralized and the decentralized permits deliberate evolution. The system can exploit whatever economies current and forthcoming technology makes available. It permits taking advantage of differing trends in the unit costs of communications and the unit costs of computer processing and adapting to a "best balance."

On the basis of our studies, we have concluded that our needs can be met best by a system which balances: the use of strategically located input/output devices to permit sharing of computer capacity by many parties, limited communications distances and related costs, making details readily available to the field, and providing summary data to Headquarters. In brief, we believe that we can achieve the best balance totally in the middle ground—the distributed computer/communications network.

In culmination of this analysis, I present the Area Control Systems/Headquarters Control System (ACS/HCS) as C&O/B&O's example of a distributed communications/computer network.

ACS/HCS is a companywide, interdepartmental, computer-based, communications-dependent data system to serve the information needs of all levels of management in all major geographic areas of C&O/B&O. It constitutes a very substantial reorganization of the clerical and machine processes and the channels of information flow into and out of the existing automated data systems. It automates areas of clerical work heretofore untouched by the computers. It captures data about car and locomotive moves in yards and terminals that have not previously been available to management in a timely way. ACS/HCS processes this data and makes it available in a form and in a time frame useful for planning, scheduling, measuring and controlling operations in the terminal and over-the-road. ACS/HCS is a complex of people, communications, computers and procedures to facilitate the performance of all basic customer service functions, transportation operations and associated clerical, accounting and administrative activities.

As implied by the title, it provides geographically distributed, but powerful computer capability to serve local processing needs. The Area computers are connected by high-speed communications lines to the Headquarters computers which serve Headquarters data processing needs. The exact number of ACS systems ultimately required for C&O/B&O is subject to further study. However, four to six appear from preliminary cost studies using our simulation model to define the probable range.

The size of the Areas to be served by each ACS will be determined in large part by the volume of Transportation/Traffic activity in the territory. The boundaries will be defined in such a way as to ensure that the needs of an Area can be handled by a single computer system in terms of service to the

users and in terms of economic and technical considerations. It may be administratively convenient for these Areas to correspond to the Operating Regions which exist on our railroad today. These generally represent logical groupings based upon type and mix of traffic, physical characteristics, traffic flow, effective span of control, etc.

It must be emphasized, however, that the ACS/HCS concept does *not* require or imply that the management and functional responsibilities of our Company will be decentralized by Area or Operating Region. In fact, ACS/HCS will support the existing management structure of the Company or any variations of this structure.

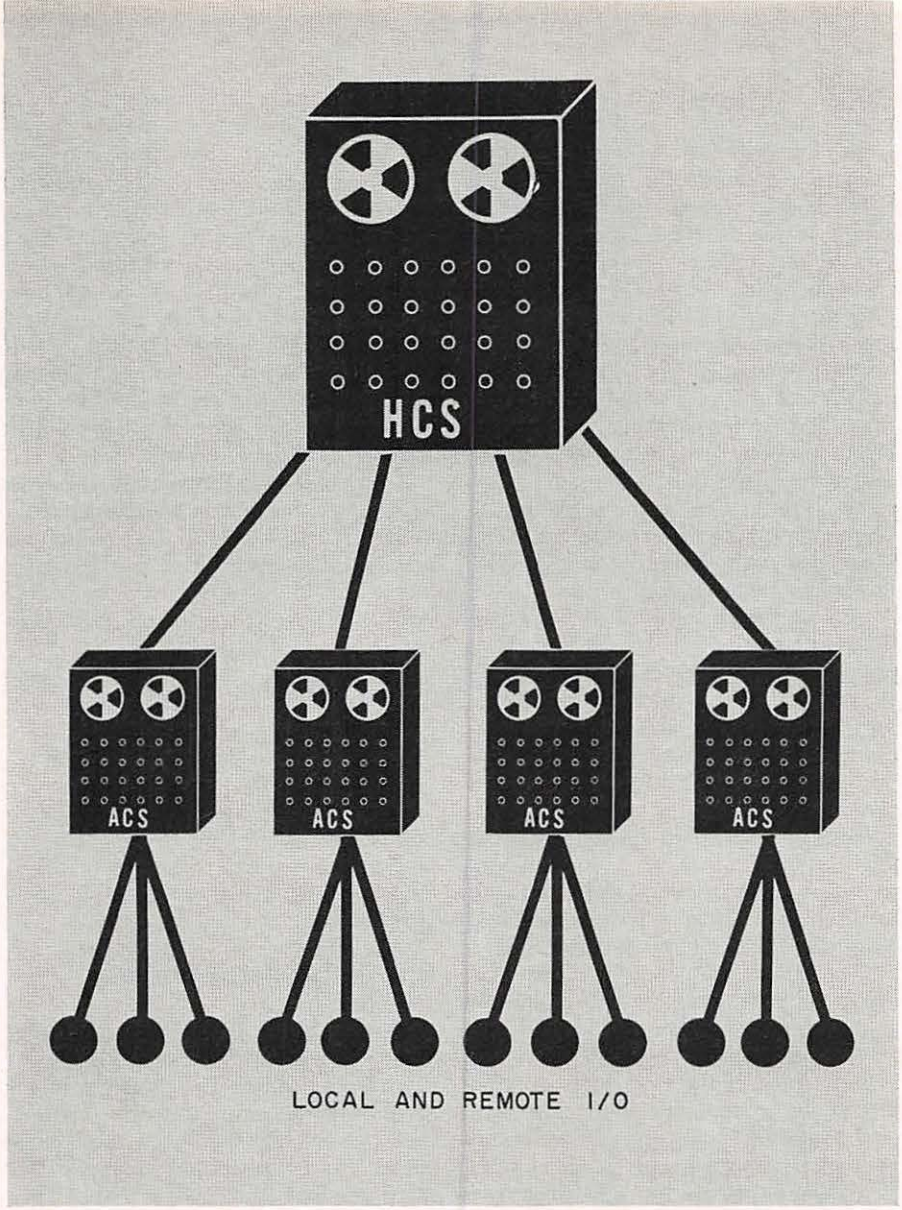
Within each Area, all data communications lines—consist, sales offices, administrative, ACI, etc.—will terminate in the Area computer and be under its control. The Area computer will function as a switcher, data concentrator, and filter for its Area. All transmissions between points in the Area will be switched and processed, where required, by the Area computer. Where the transmission is for Headquarters or for a point in another Area, the initial Area computer will relay the transmission to the HCS computer for delivery to the appropriate Area computer.

Communications circuits within the Area will be a combination of low and high speed depending upon the requirements of a particular input/output location. In contrast, the various Area computers will be linked to the HCS computer by high-speed, high-capacity lines to permit rapid, economical transmission at bulk rates.

All yards, agencies, docks, traffic offices or other facilities in the Area with sufficient volume of business to justify it will be tied to the Area computer and will have access to the information services tailored to fit their specific needs. In the same manner, the Area computer will deliver summarized, purified, extracted data from the Area to the HCS for processing there. In addition, our customers will handle their minute-to-minute service requirements with a single company-oriented organization for each Area—as you might expect, quite dependent on the Area computer.

ACS provides the computer and information support to help local management with planning, scheduling, assignment, measurement, evaluation, and control of the resources and operations under its responsibility.

ACS will impact in one way or another more than 90% of the data essential to running a railroad. This includes all basic revenue producing documents of the business, basic documents covering major sources of expense and basic records associated with the physical movement of locomotives, freight cars and cabooses.



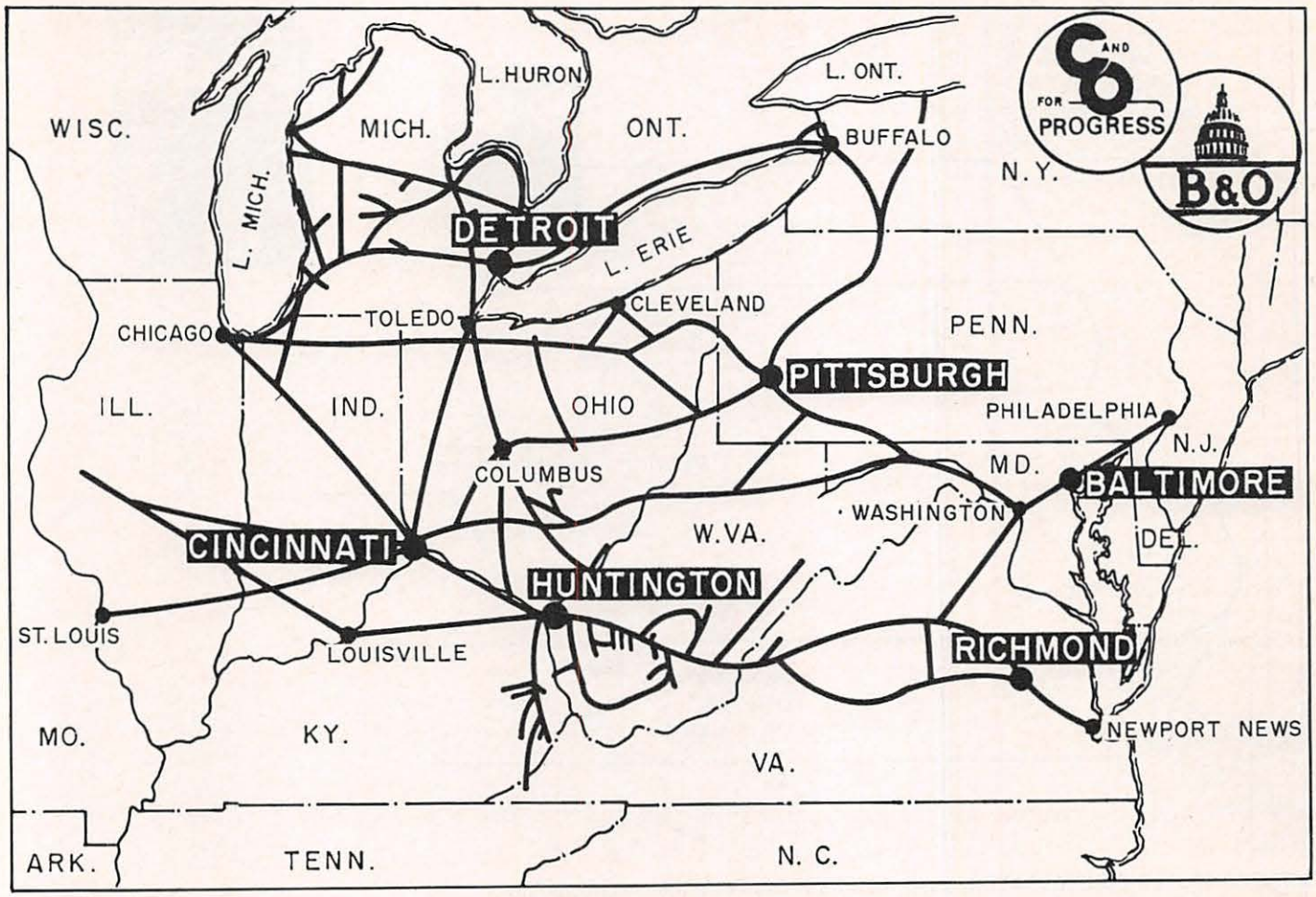
ACS/HCS is a companywide, interdepartmental, computer-based, communications-dependent data system to serve management.

ACS attacks in a meaningful way the chronic problems which erode the effectiveness of existing data systems. ACS improves data quality and timeliness in a number of ways e.g., by lending computer assistance to the preparation of source data, thus reducing dependency on clerical personnel. ACS provides improved communications facilities in the outlying areas of the railroad as well as between Area computers and Headquarters.

ACS also tackles the problems of duplication of clerical work, for example, rate quotations, routing advice, car orders and assignment. It does this mainly by integrating data systems and clerical organizations, for example, by restructuring lines of communication between customers and company personnel and by requiring multiple recording for individual uses. A classic example is the preparation of the waybill.

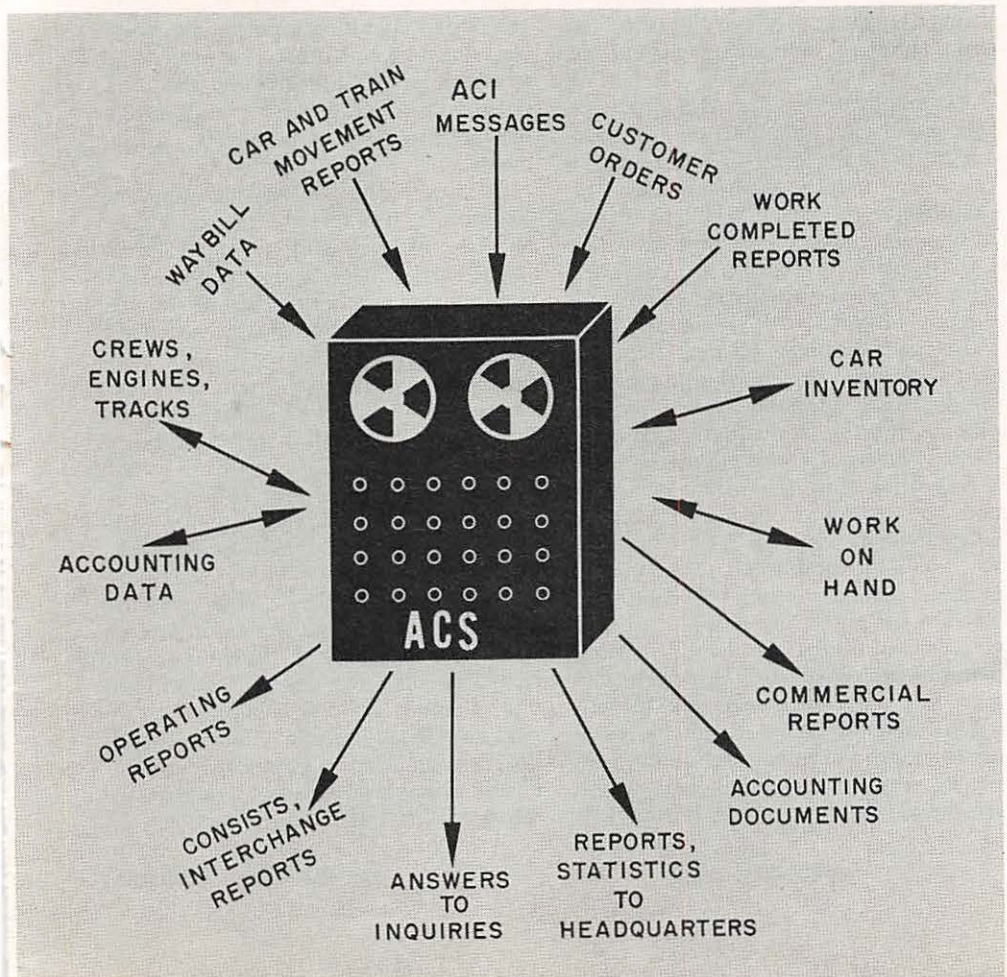
ACS provides the means for capitalizing on the potential benefits of ACI, both in reducing the existing clerical forces and also in exploiting the more timely and accurate ACI information. As you all know, to realize a return on the investment in labeling the freight car fleet, we must be able to gather ACI data into computer systems. It should be noted that ACI data will always be consumed in an ACS computer; the ACI data need never be delivered to headquarters.

ACS will be a collection and distribution point for data for headquarters. Of course, information on car and train movements will be collected and assembled, and the appropriate summary information transmitted to headquarters. But, in addition, the ACS will be a collection and assembly point for other detailed data from the field—such as time reports for payroll and material issue tickets. The collected data will then be forwarded to headquarters over high-speed communications lines for



BALTIMORE, Richmond, Pittsburgh, Huntington, Detroit and Cincinnati may be ACS headquarters.

ACS WILL IMPACT on more than 90% of essential data.

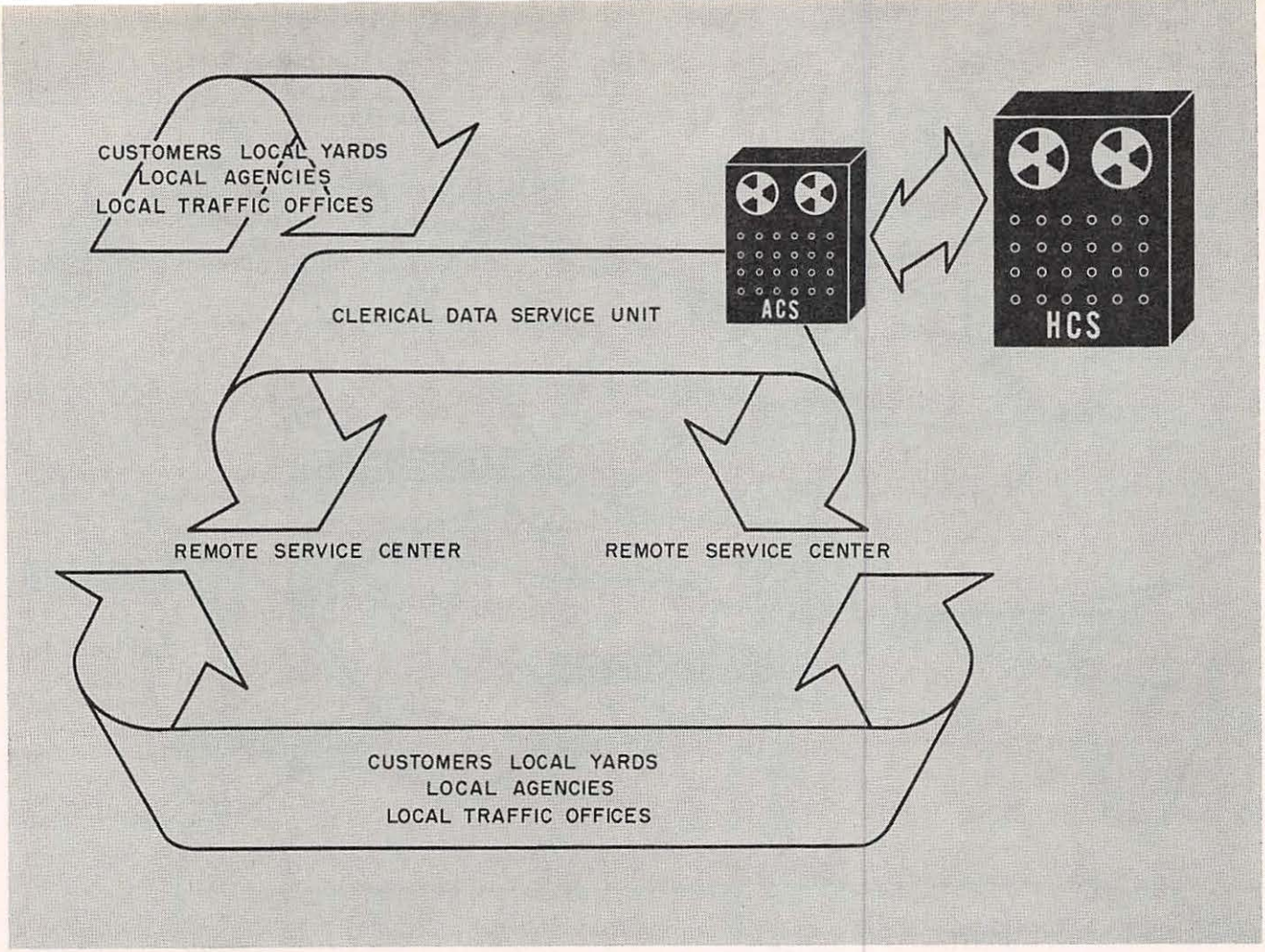


processing there. The reverse will be true where it is desired to make a widespread, rapid distribution from headquarters to the field of documents such as digital data for writing pay checks or for anticipated material receiving report forms.

That is a squint at ACS, the Area Control System. Now, what is HCS, the Headquarters Control System? In broad terms, HCS will help the headquarters staff do a better job with their systemwide functions. HCS will provide more timely, accurate and accessible information for these tasks—a case of using more fully the recently enhanced capabilities provided in new computer technology, computer simulation and Operations Research.

It will enable Headquarters to improve coordination between Areas. Based on the information furnished by the ACS's, Headquarters will know what is going on in all Areas at the same time—can look ahead and see how work in one Area will affect an adjacent Area, measure the relative performance, spot impending problems, and ensure cooperation and coordination among the Areas.

Of course, HCS will absorb those systemwide applications now per-



AREA COMPUTER CONFIGURATION might well be located at a major traffic point.

formed at Headquarters such as revenue accounting and car accounting. But of greater importance, it will support those Headquarters functions which feed on car and train movement data gathered and/or processed in ACS and forwarded to HCS for further processing. These include forecasting and planning work on a system basis for power scheduling and assignment, car redistribution, diesel servicing, car cleaning, blocking and classification, and train routing; measuring the utilization of locomotives, cars, cabooses, crews and other facilities; measuring performance for freight service quality, dock-to-dock car time train performance; measuring costs of operation; providing the ability to simulate, test and evaluate proposed changes in facilities and operations, providing traffic flow analyses; and car tracing.

In the list of main functions to be served by the eventual ACS/HCS, emphasis has been placed on Operating activities in the field. However, major Accounting and Commercial functions are also included. The intention is that information will be furnished by ACS/HCS to help plan, schedule, assign and carry out physical activities in the field and at headquarters. ACS/HCS will record when and how the activities are carried out. These records will be analyzed and results displayed relevant to the adjustment and further conduct of these activities. Reports of unusual circumstances and certain detailed and summary data will be furnished by prior standing requests or current demand.

Quite obviously, the ACS will contain an Area computer configuration and this will be located in an optimum way. To reduce communication requirements, this location is best chosen as a major traffic point, preferably the busiest place in the Area. Associated with the computer will be a small staff directly involved with the operation of the Area Computer Center. Some of the work to be processed automatically on the ACS computer is not done at all now, but the larger part of it is now done by clerks in various departments.

Supplementing the Area computer and the computer operating staff, a Clerical Data Service Unit for each ACS will be established. This unit is to be stationed around the computer, "feeding" it and using it to do a broad complement of clerical tasks for various departments. These are the people who man the telephones and talk to customers about routine matters such as car tracings, placement and pull orders, special service, car orders, etc. These are the clerks who convert bills of lading into waybills and who collect, prepare, distribute, file and otherwise "massage" transactions with or without computer aids. These are the clerks involved in generating input for bookeeping, statistics and other processing and who use reports prepared on the computer to answer questions and inform managers and others in various departments.

Because of the geographical extent of an Area, it is infeasible to consolidate all Area clerical work in the Clerical Data Service Unit next to the Area computer. A number of Remote Service Centers will be strategically dispersed throughout the Area, each such computer to be manned by one or a few clerks around the clock. These Remote Service Centers will handle customer contacts local to the geography serviced by each such remote center. Some such centers will also prepare waybills with the assistance, by communications link, of the Area computer. The greater part of the Remote Service Center activity will consist of transmitting input data to the Area computer and receiving output from the computer. These Remote Service Centers will be equipped with modern input/output devices and linked to the Area computer by communications lines of capacity commensurate with the traffic and transaction vol-

ume. The communications links will enable a Remote Service Center to function as if it were in the same room as the Area computer. Other small yards, outlying Sales office, station agencies, stores and shops will be linked to nearby Remote Service Centers and the Area Computer Center by means of digital input/output devices and by voice telephone.

The nature of ACS/HCS permits implementation in a stepwise manner even though ACS/HCS is a companywide system of broad scope. It consists of readily separable elements—each ACS and the HCS. Further, within each ACS and at Headquarters, there are groups of related functions which integrate well into various data subsystems. This enables us to approach the problems of implementing ACS/HCS in a systematic set of discrete steps, phasing in the system both geographically and functionally.

It should be observed that the computer programs for a specific set of functions in one ACS will be prepared in such a way as to fit in the next ACS where the same functions exist. Each ACS will have its own computer file structure of stations, yards, customers, waybill templates, switching agreements, etc., peculiar to its Area. But the logic of preparation of waybills and the waybill forms, for example, will be identical in each ACS.

As you can see, much of our systems planning attention has been devoted to the introduction of Source Data Automation techniques; to reduction of input errors from the field; to the decrease of the resulting clerical work both in the field and at Headquarters devoted to clean-up of the errors and their consequences in all the data streams; to consolidation within an Area of clerical activity from various departments in the field, thereby enabling elimination of duplication and enabling specialization of tasks for increased productivity especially where this permits further automation. There are very significant clerical cost reductions.

Not the least of the uses of ACS/HCS is the closing of the door on missing revenues such as missing waybills, unbilled miscellaneous services, and misposted and unbilled demurrage.

But beyond obvious communications and clerical savings, ACS/HCS provides far greater capacity for information transmission and processing. This is the capacity to be used for enabling on-line, real-time data services. The wealth of timely, comprehensive and purified data should enable managers of field operations to achieve enhanced control of their responsibilities. Greater productivity and better quality of performance in every quarter served by ACS/HCS should flow from this.

Product News

Digital printer gives hard copy in tests (101)

Model 2000 digital printer, an option device that plugs into Range Rider series pseudo-noise transmission test sets, provides hard copy during performance testing of digital transmission channels, modems, and multiplexing systems. Model 2000 printouts include time from start of test, a code to indicate what event occurred to cause each print, and a data sample.

Features include programming capability, periodic monitoring, asynchronous monitoring, multiple-channel triggering and return signaling. *International Data Sciences, Inc.*

I/O terminal makes cards and sends card data (102)

The Sycor terminal generates cards (as well as tape cassettes) and transmits card data to an identical terminal. Pertinent card data is automatically read and displayed on the cathode-ray tube, merged with other waybill information keyboarded through the Sycor terminal, and recorded on magnetic tape cassettes for subsequent transmission. After being checked on the cathode-ray tube display by the operator, waybills are printed out in hard copy through the terminal.

The Sycor terminal's format control program, stored on the format cassette, guides the operator from start to finish through easy-to-follow, field-by-field labeling displayed on the CRT. The format program also detects errors, signals them through an audible alarm, and CRT visual display—and allows for easy correction just by re-keying. *Sycor, Inc.*

Facsimile systems can send to 900 lpm (103)

Two facsimile systems are available for transmitting documents over voice-grade circuits. The 3600 series, operating at a speed of 360 lines/minute, transmits an 8½" x 11" document in three minutes. The 9000 series system, operating at 900 lines/minute, transmits an 8½" x 11" document in one minute. Additionally, both systems can be provided with an automatic document loader that holds papers 4½" to 9" wide by 4" to 14" long and will accept up to fifty documents. Also, a punched card loader is available to hold up to 100 cards. *Stewart-Warner Corp.*

Key-to-disc storage unit has controller (104)

DATA/TAPE 2100 is a multi keyboard-to-disc storage-to-magnetic-tape input system. It utilizes a programmed controller to provide a repertoire of automatic format and data controls in addition to rapid error correction. The system is expandable from 8 to 40 operators and up to 4 magnetic tape output units can be utilized.

The DATA/TAPE 2100 system consists of keyboard/printer terminals, comparative verifiers, data accumulator, disc storage, magnetic tape units and supervisor's station. DATA/TAPE 2100 provides two methods of verification. The first is full, selective or sampling key verification; the second, comparative verification. *General Computer Systems Inc.*

Service monitor is for two-way radio (105)

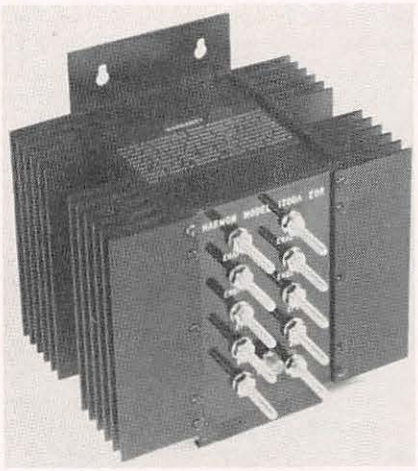
The Motorola service monitor incorporates all the functions required for exact, high resolution deviation and frequency measurements. The new synthesizor has a resolution of 100 Hz. The state-of-the-art, integrated circuit design and a unique modular building block concept make the ser-

(Please turn to page 26)

PRODUCT NEWS

(Continued from page 25)

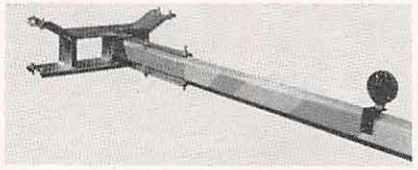
vice monitor obsolescence proof against future servicing needs and FCC requirements. *Motorola Communications & Electronics, Inc.*



Solid-state flasher handles 40 amp (106)

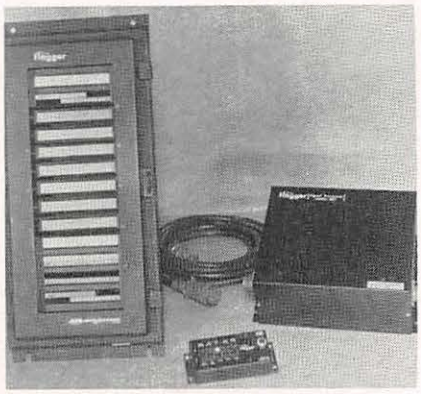
The model 1700A solid state flasher has a total lamp load capacity of 40 amp. Input voltage is 8 to 16 volts DC or full wave rectified AC. Flashing rate is 35 to 55 operations per minute.

A failure detector circuit will turn on one set of lamps in the event of a failure. The 1700A will drive average crossing equipment without a slave unit, however, a 1701A slave unit is available for crossings requiring more than 40 amp load capability. The 1700A and 1701A are designed for continuous operation at any load between zero and full rated load. *Harmon Electronics Inc.*



Gate assembly is for aluminum arms (107)

A new aluminum gate arm and adapter assembly provides for equipping existing highway grade crossing automatic gate installations with aluminum gate arms. One standard arm expands from 16 to 26 feet. It is equipped with a shear pin which permits the arm to be detached from the assembly upon impact, for example, in collision with a vehicle—yet minimum damage will be sustained. Gate lights are plug-connected, weather-proof and easily replaced. The new gate arm assembly complies with AAR specifications. *Signal & Communications Division WABCO.*



Variable ACI label is for monitoring (108)

An on-board system which monitors performance of a running locomotive or transit car, provides visual display when operation is out-of-tolerance, or when failures occur, by means of a variable automatic car identification label mounted on the side of the vehicle which can be read by an ACI scanner. The Flagger system determines the various key functions of a locomotive that are operating within acceptable ranges and records on a visual display when an out-of-tolerance condition occurs. Up to 13 monitoring features are available. A small display unit can be mounted in the locomotive to provide indications to operating personnel. *Oregon Technical Products.*

Dual disc stores up to 93.3 million bits (109)

The NCR EM-J series of dual disc units provide a total storage capacity of 93.3 million bits with an average access time of 45 milliseconds. There are 72 read/write heads per spindle and two disc packs per unit. Data transfer rate is 108,000 characters per second. Three discs are contained in each disc pack. *National Cash Register Co.*

Crossing gate can be up to 40 ft (110)

The type D automatic highway crossing gate mechanism is capable of handling gate arms up to 40 ft in length with a maximum clearing time of only 10 seconds. The mechanism is designed for low-voltage, DC operation. A sidewalk arm is available as an option. *General Railway Signal Co.*

Expanded communications in new processor (111)

System/370 model 135, the newest and lowest-cost model in the series, offers expanded communications capabilities as well as significantly improved performance to users of medium-size and smaller IBM computers.

System/370 model 135 offers low-cost entry into tele-processing applications. Up to eight communications lines can be connected directly to the central processor, eliminating the conventional need for a separate data adapter unit. This capability is made possible by an optional integrated communications attachment. Many remote terminals and processors can be attached to each communications line.

Another optional feature, the integrated file adapter, permits direct attachment of the three-disk IBM 2319 direct access storage facility without the use of a separate control unit. Two additional disk drives can be added to the 2319 to provide up to 145-million characters of economical, direct-access storage.

Main memory sizes for the model 135 range from 96,000 to 240,000 characters of data, a maximum nearly four times greater than that of the model 30. The model 135's ability to

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47	**48**	**49**	**50**	**51**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**
119	**120**	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**	**136**	**137**	**138**	**139**	**140**	**141**
142	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**	**151**	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**				

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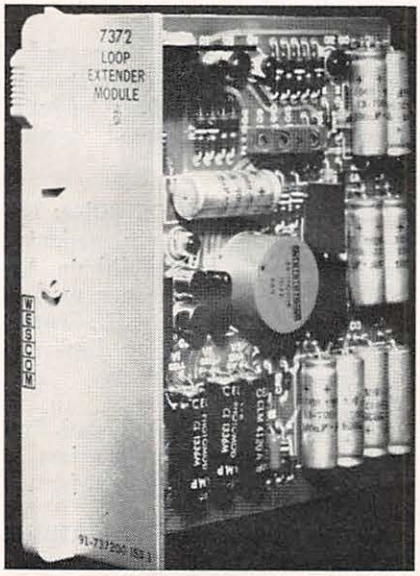
use IBM's most powerful disk storage devices—including the recently announced 3330—adds to its capacity for data base applications.

An additional 24,000 characters of monolithic memory is provided for the model 135's reloadable control storage (RCS), which holds all the instructions required for system control functions and selected optional features. These instructions are read into RCS from a disk cartridge supplied by IBM.

If required, the RCS capacity can be expanded to 36,000 or 48,000 characters to accommodate optional features such as extended precision arithmetic or emulation of the earlier IBM 1400 series of computers.

Most users of System/360 will not need to reprogram their existing applications to move up to the model 135. In addition, the model 135 permits users to run their disk operating system programs under control of the more powerful operating system at no additional charge. *Data Processing Division, IBM Corp.*



Unit extends supervisory dial and ringing (112)

A new "battery boost" loop extender module No. 7372 extends the subscribers supervisory, dialing and ring trip range from a central office. The plug-in module inserts a floating voltage source in series with the tip and ring conductors in the central office. Individual battery boost per card is derived from an internal DC to DC converter. This converter is automatically turned off when the circuit is idle. As little as 6 ma of loop current will cause the converter to turn on after which loop current is regulated to eliminate the need for voltage strapping options on intermediate length loops. The 7372 Extender provides loop current in excess of 23 ma on a 3000 ohm loop. The 7372 module can be used on loop or ground start circuits, coin lines, SATT, ANI and spotter dial operations. The loop extender provides DC boost during the ring interval to aid ring trip. *Wescom, Inc.*

Remote terminal handles wide formats (113)

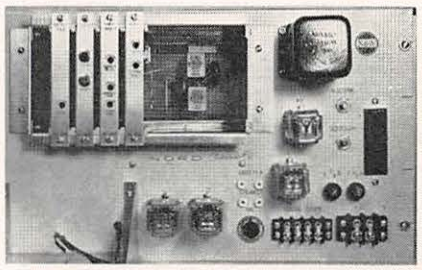
Wide-format reports generated by computers can be received at remote locations with a new model 37 terminal, which has a 15" platen to accommodate standard 15" sprocket-fed computer print-out paper. Model 37 operates at speeds of 15 characters per second.

Model 37 terminals accept all ASCII code combinations and commands. They will be available as RO (receive only) sets, KSR (keyboard send-receive) sets, and ASR (automatic send-receive) sets with a paper tape punch and reader module, a magnetic tape module, or with both paper tape and magnetic tape modules. *Teletype Corp.*

Time-element relay is slow-release (114)

A slow-release, plug-in time element relay has a release time of 8 to 10 minutes. This relay was especially developed to deenergize the directional stick relays in a highway crossing after a predetermined time. The relay is normally energized through the back contacts of the directional stick relays, in series, and its front contacts are in the control circuits of the directional stick relay.

When one of the directional stick relays is energized, energy is removed from the PD1XT time element relay and after a predetermined time (5 to 10 minutes) the front contacts of this relay open and, in turn, restore the directional stick relays to normal, making for a completely failsafe time element operation since if the relay, for some reason, becomes deenergized due to broken wire or other causes, the circuits for the directional stick relays are opened and "lock out" is prevented. *Transcontrol Corp.*



System provides base station control (115)

The new model NI 1100 base station radio control system provides reliable communication between dispatcher, train crew, and maintenance team. A typical installation consists of a 35 watt two-way radio, antenna, digital controller, and battery with charger.

The dispatcher activates the base station using a 60 AP type selector or selective tone. Transmission from a moving train or other mobile radio is by way of a unique pulse code method incorporated in the push-to-talk button. *Nord Instruments Co. Inc.*

Catalogue describes battery chargers (116)

A new catalogue describes battery chargers, battery eliminators, single and multi-frequency ringing generators, standard and precise tone generators, DC-DC converters, DC-AC inverters, power boards, ringing plants, and ringing power boards. Its 16 pages are illustrated with concise statements of design benefits; features tabular listing of performance specifications and physical and mounting dimensions. *Warren Communications.*

I/O terminal can operate up to 600 baud (117)

The 1240 communication terminal prints and transmits data at 10, 15, 30 or 60 characters per second. In addition, the 1240 features 94 printable graphics on a 60-key ASCII keyboard, and a 120-character writing line. The 1240 takes up to 14⅞" width, 6-part forms. It handles continuous form paper and single-sized sheets, with horizontal, local or remote tabulation capability.

It has both full and half-duplex integral modems and can operate at 110, 150, 300 or 600 baud. Error checking is available. *Memorex Corp.*

People

BURLINGTON NORTHERN: **M. M. Donahue** appointed assistant vice president-management services.

CHESAPEAKE & OHIO/BALTIMORE & OHIO: **C. H. Coovert** appointed system signal inspector, Huntington, West Va. **W. W. Stewart** appointed assistant signal supervisor, also at Huntington. **J. B. Hardgrove** appointed supervisor of signals, Ashland, Ky. and **J. E. Stark** appointed assistant supervisor signals, Wyoming, Mich.

C. J. Nicely appointed assistant engineer signal materials & standards. **S. N. Anderson** appointed signal application engineer. **W. Cartee** appointed engineer signal materials & standards. **G. L. Wise** appointed engineer signal equipment. **M. E. LaCross** appointed senior circuit engineer signals. **P. D. Finnell** appointed circuit engineer signals. All the above men are headquartered at Huntington, W. Va. At Grand Rapids, Mich., **K. E. Willyard** appointed regional supervisor communications and **J. R. Barnett** appointed assistant regional supervisor communications.

CHICAGO & NORTH WESTERN: **Thomas M. Evans**, communications engineer, appointed assistant chief engineer communications and signals at Chicago.

LOUISVILLE & NASHVILLE: **Charles L. Mathis** appointed radio inspector. **Warner C. Lawson**, chief communications installer, Mobile, Ala., appointed assistant outside plant inspector, Louisville. **Crayton S. Owens** and **Bill J. Haynie** appointed assistant circuit designers, also at Louisville.

PENN CENTRAL TRANSPORTATION CO.: **H. Alexander**, engineer C&S-maintenance, Philadelphia, appointed system engineer-C&S-maintenance there. **J. G. Cunningham**, regional engineer-C&S, Philadelphia, appointed engineer C&S-staff, Philadelphia. **J. E. Hartfield**, regional engineer C&S, Detroit, Mich., appointed engineer C&S-maintenance, Philadelphia. **D. G. Shiels**, regional engineer-C&S Indianapolis, Ind., appointed engineer C&S-maintenance Indianapolis, Ind. **L. E. Light**, regional engineer C&S, Pittsburgh, Pa., appointed engineer C&S-maintenance there. **E. E. Harris, Jr.**, regional engineer-C&S, Chicago, Ill. appointed engineer C&S-maintenance, Toledo, Ohio. **F. G. Fotta**, regional engineer C&S, New Haven, Conn., appointed engineer C&S-maintenance, Albany, N.Y. **E. W. Simpson**, general inspector C&S, Detroit, Mich., appointed staff engineer-C&S, Toledo, Ohio. **C. W. Lowry**, project engineer-C&S, Indianapolis, Ind., appointed assistant production engineer-C&S, there. **R. F. Jones**, assistant field engineer-C&S, Indianapolis, appointed assistant production engineer-C&S there. **W. D. Simmers**, assistant field engineer-C&S, Williamsport, Pa., appointed assistant production engineer-C&S there. **E. E. Curtis**, assistant field engineer-C&S, Pittsburgh, Pa., appointed assistant production engineer-C&S there. **J. A. Crawford**, assistant field engineer-C&S, Logansport, Ind. appointed assistant production engineer-C&S, Chicago. **E. J. Govin**, estimator-C&S, New Haven, Conn., appointed assistant production engineer-C&S, there **E. J. Joscelyn**, system engineer-C&S, Philadelphia, appointed system analyst-C&S there. **C. D. Rodriguez**, assistant engineer-C&S, Philadelphia, appointed system analyst-C&S there. **M. L. Ruster**, statistical analyst, Philadelphia, Pa., appointed statistician-C&S, Philadelphia. **R. H. Boyd**, material engineer-C&S, Philadelphia, appointed statistician-C&S. Other appointments in the Philadelphia headquarters are as follows: **D. D. Asbell**, operational analyst-C&S, in Indianapolis, appointed statistician-C&S. **K. A. Gelston**, manager radio system, appointed radio engineer. **J. L. Smith**, field engineer-C&S, appointed radio engineer. **J. R. Stuart, Sr.**, system engineer-C&S, appointed standards engineer-C&S. **G. R. Santoff**, cost and material engineer-C&S, Pittsburgh, appointed material engineer-C&S. **R. R. Spellman**, general signal inspector, Syracuse, N.Y., appointed general inspector-C&S, Albany, N.Y. **E. J. Seybold**, staff engineer-C&S, Detroit, has retired, **R. H. Neely**, inspector C&S, Pittsburgh, has retired.

Thomas M. Evans
Chicago & N. West.

James Anderson
ACI Systems Corp.

Leland G. Phillips
S&C Div. WABCO

W. R. Fisher
S&C Div. WABCO

SEABOARD COAST LINE: **B. Leon** appointed senior communication engineer and **C. O. Culler, Jr.**, appointed assistant electronics engineer, both at Jacksonville, Fla. **L. M. McLean**, senior communication engineer, Jacksonville, retired.

Suppliers

ACI SYSTEMS CORP: **James Anderson**, formerly manager of transportation control systems for Computer Identics Corp., appointed general marketing manager.

COMPUTER IDENTICS CORP: **Edmund R. Poole**, formerly marketing director, printing and publishing, Avco Corp., appointed manager, marketing communications. **James L. Cooper**, former marketing manager, Radiation Inc., appointed field engineer.

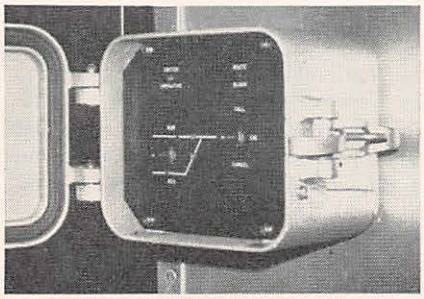
THE OKONITE CO: **William J. Patterson** appointed district manager at Miami, Fla., wire and cable division.

SIGNAL & COMMUNICATIONS DIV., WABCO: **W. R. Fisher**, eastern regional manager, Philadelphia, appointed eastern sales manager, with headquarters at Swissvale, Pa. **Leland G. Phillips**, southwestern regional manager, St. Louis, appointed western sales manager, at Swissvale, Pa.

UNION CARBIDE CORP: **F. Bruce Vernon**, executive vice president, carbon products division, appointed president.

WESTINGHOUSE ELECTRIC CORP: **Dr. W. E. Johnson**, vice president and general manager of the astronuclear/underseas division, appointed vice president and general manager transportation division succeeding **W. P. Bollinger**, who was appointed assistant to the general manager.

News Briefs



Local control is feature of BN CTC

Burlington Northern has installed centralized traffic control on its Columbia river line between Wishram and Vancouver, Wash., 96 miles. Control is from a Traffic Master machine at Vancouver. Equipment was furnished by General Railway Signal Co. for this CTC system.

A unique feature of this system is the provision for safe, semiautomatic local control of each controlled location, by the train crew, in the event of failure of the code line.

At each controlled location, a small, weatherproof, padlocked box is mounted on the outside of the equipment case. A panel inside the box contains levers to operate the switch machine and signals, and indicators which show the switch position, operative condition of the switch machine, and any track blockage that may have been put into effect by the control console operator. This panel automatically becomes operative if the code line should fail.

Associated equipment, housed in a single type J relay cabinet, checks for track occupancy as far as the next controlled location and, should the track be occupied, prevents the signal from clearing. The train crew must then operate the panel lever to reverse the switch so the train may move onto the siding until the way is clear. Once the route is cleared for a train, the system will hold any approaching train at the next interlocking until the first train clears. A code-or carrier-sensitive relay detects any code line outage which may occur and activates the system.

Emergency board set for BofRS-RR dispute

On March 4, President Nixon appointed an emergency board to investigate the dispute between the nation's railroads and employees represented by the Brotherhood of Railroad Signalmen. Paul N. Guthrie, head of the ceconomics department, University of North Carolina, is chairman. Other members include Mrs. J. T. McKelvey of the New York State School of Industrial Relations, Cornell University; and Thomas G. S. Christensen of New York University law school. The board is to report to the president within 30 days and for 30 days thereafter no change shall take place unless the parties reach agreement.

FCC ok's microwave for motor carriers

Federal Communications Commission has granted construction permits in the motor carrier radio service to the Preston Trucking Co. for an extensive shared private microwave system for trucking companies between Tonawanda, N.Y. and Philadelphia, Pa. According to *Telecommunications Reports*, the private microwave system is to be built, owned and maintained by Transportation Microwave Corp. and made available under a lease arrangement to the licensee and other truckers.

Preston Trucking, it was specified in the applications, is to have the "sole right to control" the system, with each participant "enjoying and exercising the right to use cooperatively" the system in accordance with the sharing agreement. Preston Trucking also has "sole right" to maintain and repair the equipment, with other participants contributing equally to the expenses.

The proposed system would use 10 megahertz channels in the 6575-6875 MHz band. It would have a capacity of 720 voice channels, or an equivalent of 12,960 teletypewriter channels, or a combination of both. It was estimated that about 40 to 60 trucking companies would share the system initially.

The $3,500,000 system would link Buffalo, Rochester, Syracuse, Utica, Albany, New York and Philadelphia. It is scheduled to go on the air April 15.

The charge to sharers would be 50 cents per airline mile per month for dedicated voice grade channels assigned for use by any specific participant. Similar rates for teletypewriter use would be 10 cents a mile, for up to 150 baud capacity. A security deposit by each participant, based on planned use of facilities, would be used as a "special fund" for extraordinary situations.

D&RGW will install 10 hotbox detectors

Denver & Rio Grande Western has ordered 10 sets of Wheel Thermo-Scanner equipment from General Railway Signal Co. Six sets of these hotbox detectors will be installed at Pine Cliff, Granby, Florence, Buena Vista, Dotsero and Una, Colo. Four sets of hotbox detectors will be installed at Floy, Woodside, and American Fork, Utah.

UP class yard to open in fall

A $2.8 million retarder classification yard is scheduled for completion August 1, 1971 by the Union Pacific at East Los Angeles, Calif. The 16-track yard will feature automatic, weight responsive retarders and automatic switching equipment furnished by General Railway Signal Co.

SP amends proposals for microwave system

Numerous changes in its applications for a 95-microwave station specialized common carrier system between East St. Louis, Ill., and Los Angeles were proposed by Southern Pacific Communications Co. in filings made last month with the Federal Communications Commission. Similar amendments were filed in November for the proposed 57-station network between Seattle and San Diego by SP.

Compucon Corp. has studied the proposed systems to make them as free as possible from interference with existing or authorized systems. J. N. Albertson, vice-president and general manager, SP Communications Co., said "The study was made by feeding

(Please turn to page 30)

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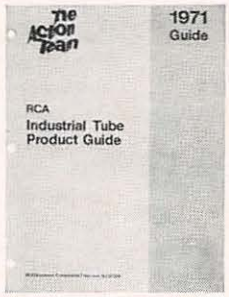

Need more reasons? Call your local RCA Industrial Tube Distributor. For starters, ask him for the new 1971 Guide to RCA Industrial Tube Products, or write: RCA Electronic Components, Commercial Engineering, Dept. 135D, Harrison, N. J. 07029.

RCA

NEWS BRIEFS

(Continued from page 29)

base information of all authorized and existing stations into a computer, developing a computer base, and then calculating possible interference. Various interference-free frequencies were selected by Compucon based on the computer results and geographical profiles."

Consequently, various changes were proposed in the pending applications, including equipment, tower, and antenna changes.

N&W applies to FRA to install CTC

Norfolk & Western has applied to the Federal Railroad Administration for approval of a proposed installation of traffic control system replacing existing automatic block signal system on single main track between Jacksonville and East Hannibal, Ill., about 64 miles.

Ann Arbor awards radio maintenance contract

A 10-year contract for the lease-maintenance of a radio communications system covering base and mobile units for the Ann Arbor has been awarded to Syntonic Technology, Inc. The agreement calls for Syntonic to supply, install and maintain locomotive, automobile, portable and remote base station radio units along that portion of the railroad system, running from Toledo, Ohio to Owosso, Mich., 106 miles.

Southern to begin yard construction

Late this fall Southern will begin construction of an automatic retarder classification yard at Sheffield, Ala. According to W. Graham Claytor, SOU president, the $11 million yard will include electronically controlled switches, retarders, scales and a complete radio communications network. It is planned to open the yard for service in late 1972.

UP puts ACI in service at Julesburg, Colo.

An automatic car identification scanner has been installed at Julesburg, Colo., on the Union Pacific to scan all eastbound trains headed for Bailey yard at North Platte, Neb. Out-

(Please turn to page 32)

Letter

FCC and Telpak

Feb. 11, 1971, Philadelphia, Pa.

To the Editor:

In your article on "Capital Spending on Systems Control" which appeared in the January 1971 issue of RSC, you stated that "on February 15 revised (and generally higher) tariffs will go into effect for TELPAK bulk communications services". This statement is not accurate. It is true that the FCC has been ordered to file revised TELPAK tariffs, extending sharing to all private line customers without regard to their lines of business; however, this order does not require the filing of increased rates.

The FCC, in their order, stated that "if the filing of these revised tariffs would result in a lowering in the rate of return, AT&T could file, under normal administrative procedures, for a rate adjustment". Incidentally, the February 15 date has been extended to March 3. AT&T, in the course of the TELPAK rate and sharing investigations, has repeatedly stated that broadening of sharing would naturally affect the rate of return and could result in the elimination of TELPAK. This is a distinct possibility; however, the principle of bulk rates for large users for common carrier communications service has been established by the FCC provided that there is no discrimination among users.

At this time it is not known what action AT&T will take other than their appeal to the courts to request a review of the FCC decision. It is possible that if AT&T decides to withdraw the TELPAK tariff they will substitute another form of bulk tariff arrangement having a different and probably higher and more costly rate structure. Still pending are decisions by the US Court of Appeals in Washington as to the legality of the previous two TELPAK rate increases. The matter is further muddled by FCC Docket 18128 which is the private line rate investigation and incorporates the TELPAK tariffs. This investigation began prior to the FCC order to eliminate the discrimination in TELPAK and broaden sharing and the evidence as to the affect of this order has not yet been incorporated in the proceedings.

Where we go from here is, at this time, anybody's guess.

R. C. Karwatt, Director
Communications Services,
Penn Central Transportation Co.

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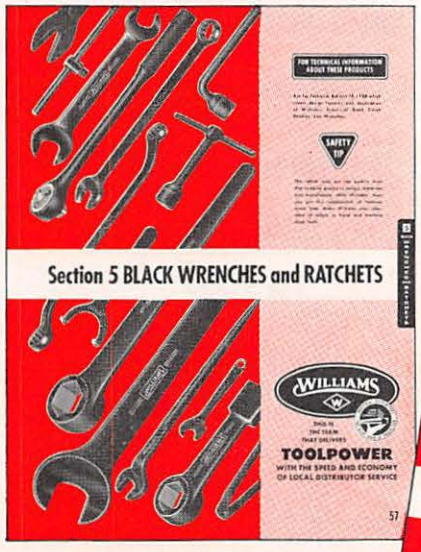

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NEWS BRIEFS

(Continued from page 30)

put from the scanner and decoder will provide the yard with an advanced list of all cars on incoming trains to be double checked against the advance consist report. Data from the ACI system will travel over UP's microwave system to the Bailey yard office where output will be on a teleprinter.

RF&P and SCL ask to drop train stop

Seaboard Coast Line and Richmond, Fredericksburg and Potomac are seeking to discontinue an intermittent inductive automatic train stop system on 584 road miles which includes 912 track miles which covers several points on the RF&P where SCL trains are operated, and also includes two major portions of SCL between South Rocky Mount, N.C. and Chatham near Savannah, Ga., 369 road miles and Savannah and Waycross, Ga., 90 miles. Reason for requesting discontinuance is as follows:

Discontinuance and removal of the ATS system will permit a more efficient and economical utilization of locomotives owned by the SCL many of which are not equipped with ATS devices, and hence cannot be operated in ATS territory. If permitted to discontinue the ATS system SCL will through resultant savings in maintenance expenses be able to devote more money and manpower to other far more productive safety efforts, such as improving roadbed and track and extending CTC systems.

FCC revises antenna tower painting rules

Federal Communications Commission issued an amended rule change concerning section 17.23 and section 17.43 of its rules concerning the construction, marking and lighting of antenna structures. Basically, the change is that the alternative bands of aviation surface orange and white shall be of equal width, approximately ⅓th the height of the structure and provided that the band shall be not more than 100 ft nor less than 1.5 ft in width. The provisions for the new widths (the change being from a maximum of 40 ft to a maximum of 100 ft) were effective Nov. 1, 1970, for all new structures or for change in height or location of an existing antenna structure. All existing antenna structures required to be painted shall be repainted to meet the new rules no later than Nov. 1, 1977.

WMATA seeks data on fare collection

The Washington Metropolitan Area Transit Authority (WMATA) has requested proposals for the engineering development of automatic fare collection equipment to be procured for the 98-mile Metro system.

The fare collection system will be obtained through a phased procurement involving two separate major contract actions. The first will be an engineering development contract to be obtained by competitive negotiation following an industry-wide request for proposals.

In this phase, a prime contractor for the entire system will be selected. The contractor will be required to provide precise planning of system design, delivery schedules, engineering models, and cost factors prior to commitment to a full-scale production contract.

The second action will be production and installation of the equipment, to be negotiated with the same contractor who performs the engineering development.

The Metro automatic fare collection system will provide the means for passenger fare collection, control of station entry and exit, accurate recording of fare transactions, and the secure transport of collected funds.

The system will be based on the stored-value concept utilizing a magnetically-encoded card to accommodate patrons using Metro stations, parking lots and connecting bus facilities.

The system will be electro-mechanical in nature, involving the use of electronic logic circuits, modern gates, and new types of equipment. It will include card vending machines, money changing machines, and equipment capable of adding value to the fare cards. The system also must provide for necessary repairs and be capable of interface with bus equipment.

A request-for-proposal document is available and can be obtained from the Washington Metropolitan Area Transit Authority, 950 South L'Enfant Plaza, S.W., Washington, D.C. 20024.

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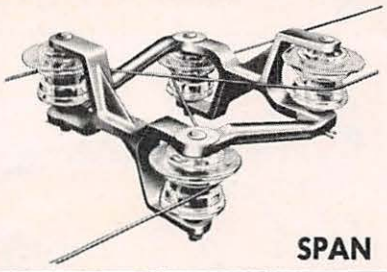
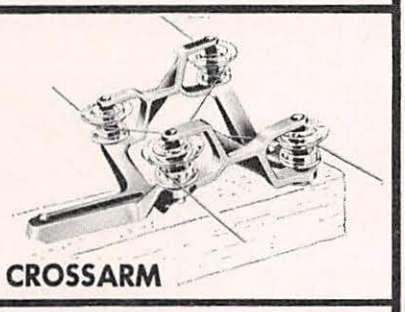


SPAN



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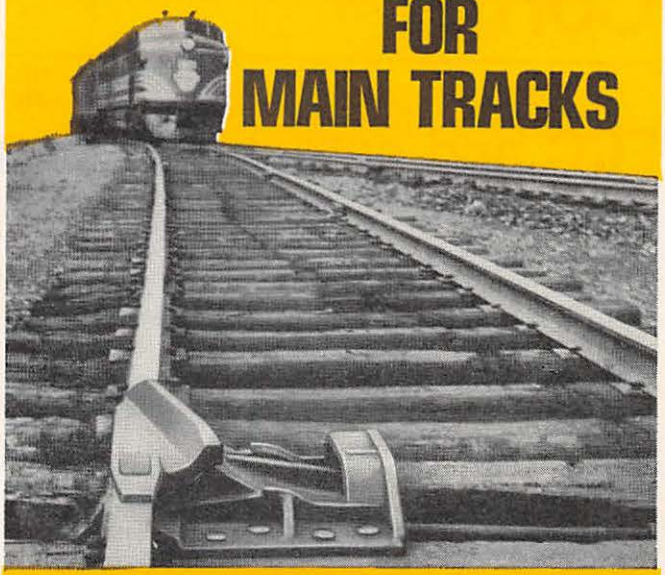

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Editor's Corner

FCC and communications: In limbo?

The benefits to a railroad in having its own communications facilities are becoming more apparent as a result of recent legal maneuverings involving the telephone companies, large communications users and the Federal Communications Commission. As of this writing (March 22), the U.S. Court of Appeals in Washington has before it requests for a ruling on the legality of two previous Telpak (bulk communications) rate increases. Another U.S. Court of Appeals in New York City has received requests from American Telephone & Telegraph Co., Western Union and others to stay an FCC decision to permit unlimited sharing of Telpak. Also, the FCC has issued a temporary stay on its unlimited sharing order until the New York court could hear the appeals. The court had set March 29 as the date to hear oral arguments.

"Needless to say, all this uncertainty makes it very difficult to budget and plan for future communications," writes Robert C. Karvwatt, director communications services, Penn Central Transportation Co. (See Letter to the Editor on page 31). He is not alone in his comments regarding the situation.

REVENUE LOSS SAYS AT&T

Charles H. Miller, general marketing manager, Long Lines, AT&T, in a motion for a stay pending review said that "losses from unlimited Telpak sharing will be so severe that, absent a stay of the Commission's orders it is probable that AT&T will find it necessary, while the orders are still under review, to initiate changes in its private line rate structure that will either raise significantly the level of Telpak rates or abandon, for all practical purposes, the concept of a bulk rate offering.

"Because of the structure of the Communications Act and the discretionary authority of the Commission thereunder, a considerable period of time is likely to elapse before these rate changes would be permitted to become effective. In the interim, AT&T will suffer irreparable revenue loss and both AT&T and present Telpak users will be uncertain as to the rate structure that ultimately will be applicable to private line service," he said.

In making a study of the situation, Miller said that trucking and railroad Telpak users would enlist others to move into Telpak D categories from present Telpak C use. "The net effect on the total private line market of the combining of Telpak Cs into Telpak Ds and individual private line services into Telpak Cs and Ds, together with a general increase in average Telpak fills, will be a reduction in total private line revenues of about $94 million annually."

For rail managements and their communications officers it's not only confusing, but presents problems at this time when earnings are low. Now more than ever with the growth of railroad communications traffic, there is a need for stability in communications rates.

All railroads are somewhat affected by the Telpak-private line and general rate investigations of the FCC because communications must be maintained via the public telephone network—to off-line traffic offices and to customers. Those railroads with their own communications facilities—pole lines and/or microwave—are in the enviable position of not being affected by rate increases in the handling of the bulk of their voice and data traffic via on-line facilities.

For railroads, as well as others, the relaxed interconnection regulations mean that they would not be required to lease the connecting or interface equipment from the telephone or telegraph companies. Some experts forecast that this will be an increased incentive for many railroads to purchase their own dial telephone exchange equipment, data sets and computer input/output units such as teletypewriters, all of which can be interconnected to the public telephone system. Many railroads will find it advantageous to purchase such units for their off-line traffic offices, which heretofore had to be equipped with telephone or telegraph company equipment.

RE-EXAMINE POLICIES

It would certainly appear that because of the present confused or "suspended" communications regulatory situation, many railroads will be re-examining their communications policies with the possible goal of providing their own facilities wherever possible. It will require cost/benefit analyses. Also, it may be advantageous for a road to lease facilities from a third party that is not a communications common carrier.

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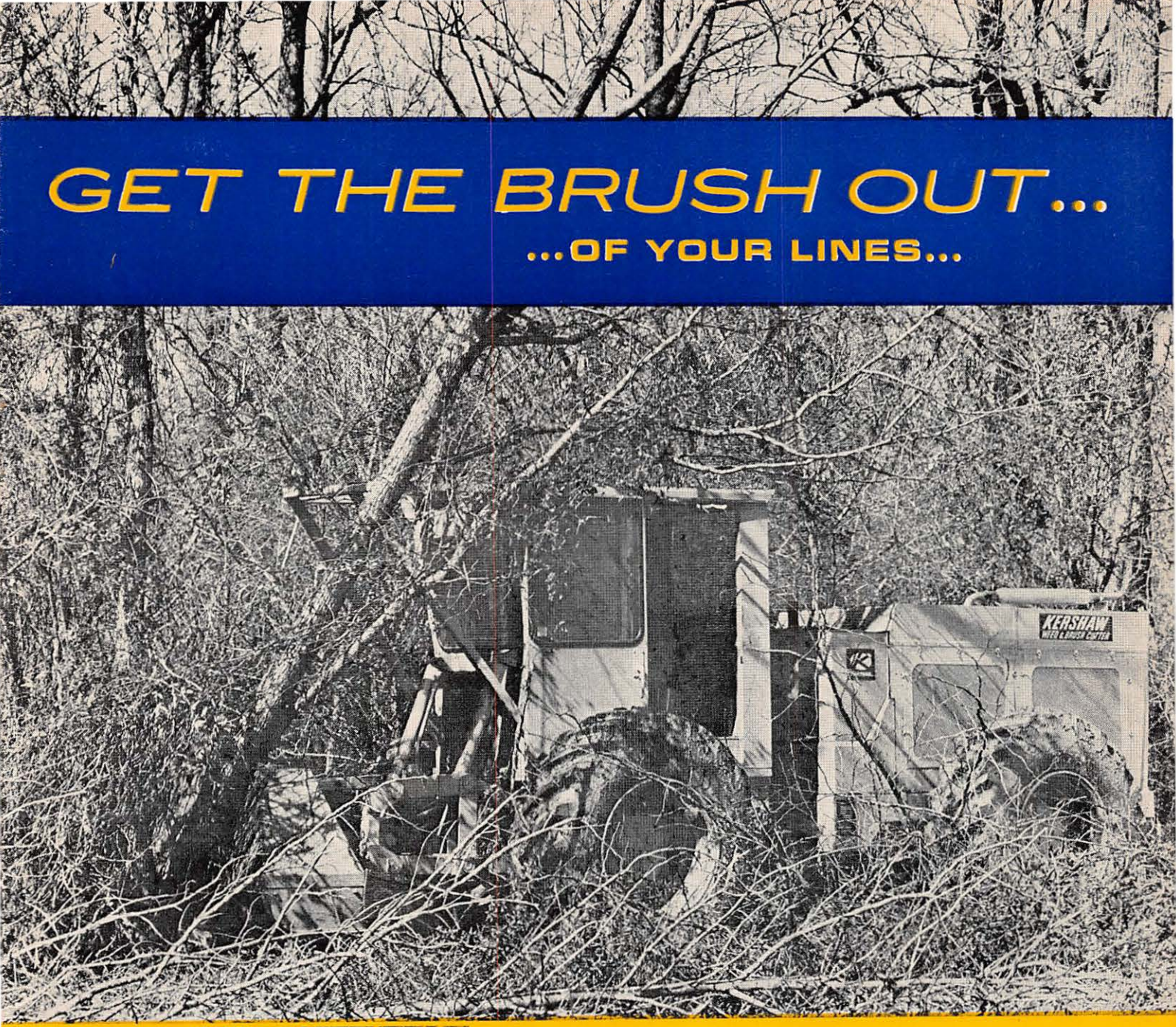

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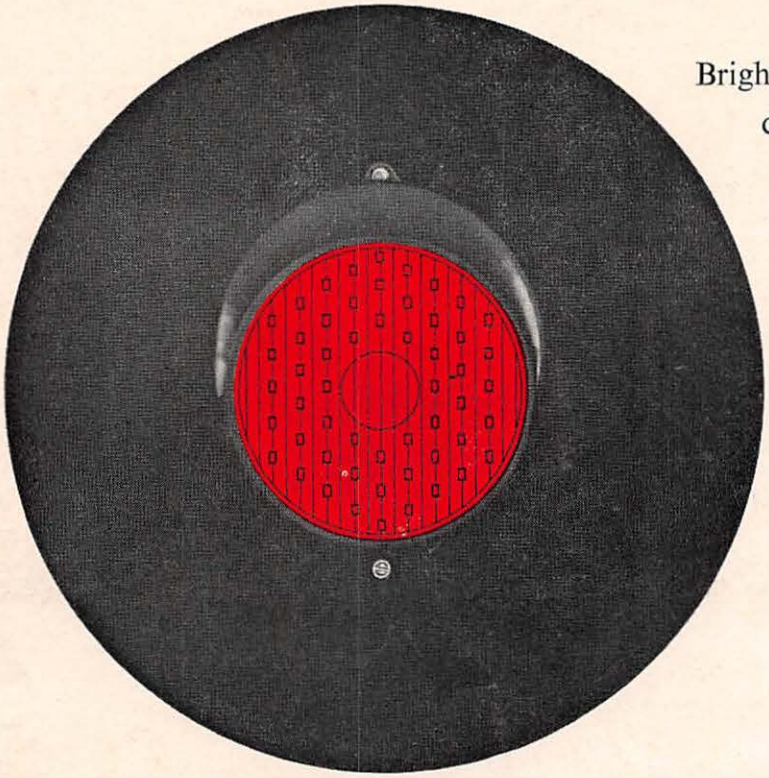

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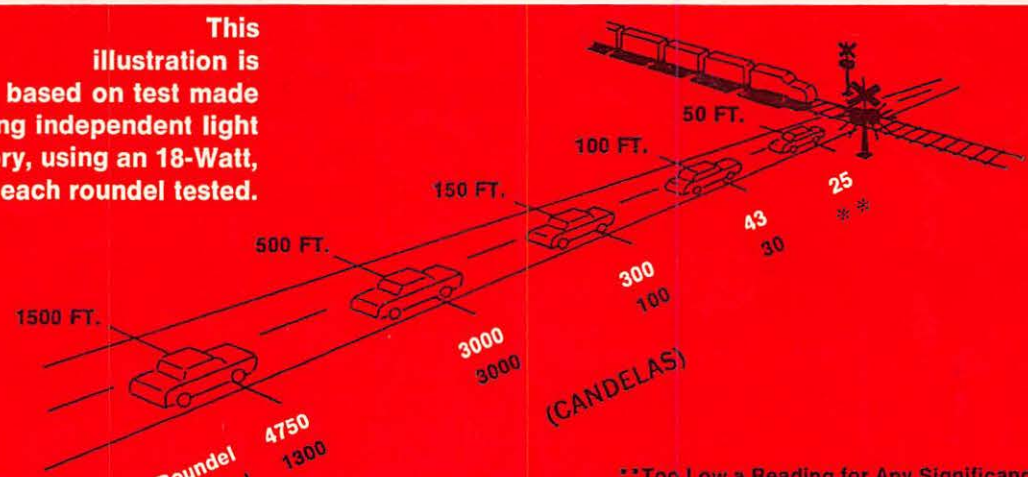

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